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CENTRIPETAL NEW YORK.

Apparently there comes a time in the affairs of every great commercial and industrial institution in this country, when they find it desirable or convenient or best to remove from their old habitation to New York; and this is true not less of individuals than of corporations. We shall not attempt to explain this phenomenon, but wish simply to make note of it with the latest illustrations. This week the prediction we have often made that the American Bell Telephone Company would move from Boston to this city is verified. The reason perhaps is that with a future before it requiring the resources of a larger money market for the expansion of its business than Boston can afford, it comes here, to the financial metropolis that the "independent" movement has already made its chosen headquarters. But the Bell Telephone interests in their action were anticipated nearly ten years ago by the Thomson-Houston interests, which, peculiarly New England in origin and development, have their final home to-day in this city.

It might be thought that electricity per se had something to do with this, but we apprehend that such is hardly the case, except so far as the telegraph or telephone has contributed toward making New York a centre from which every influence can radiate immediately and to which every condition can be reported instantaneously. At the very moment when the Bell Telephone interests desert Boston, it is announced that the National Steel, American Tin Plate and American Hoop Companies, with $160,000,000 capital, all hailing from Chicago, have taken 22,000 square feet of office space on Park Row, this city, and will bring hundreds of employees here, besides adding $300,000 directly to the tax receipts. And as though this were not enough, Mr. Yerkes, of Chicago, has finally sold out all his millions of street railway stocks there, and will now occupy his New York home and do business here. It would take more of our space than we can spare to add the names of other rich men coming to New York to reside, but it seems to us worth while to point out that the Bell Telephone people are after all only partaking in a general and apparently irresistible centripetal movement toward New York City. That business will be done more rapidly and thoroughly and economically goes without saying, but it may be suggested that besides the attractions of New York as a residence and business centre some sections of the country have been less friendly to the aggregations of wealth and skill that are an integral part of modern development and civilization.

OUR FAR EAST.

Now that this country has projected itself into the Far East and become an Oriental Power, with the great probability of helping to administer China in the near future, it has become imperative to secure better cable communication with our possessions and responsibilities. It is a thing that must be taken in hand at once, for there is apparently no letting-go possible in the Philippines, while it is certain that no self-respecting American will ever allow the Chinese door to be slammed in his face. President McKinley takes up this matter in his presidential message to Congress, and goes so far as

to remark: "The Japanese government has shown a lively interest in the proposition of the Pacific Cable Company to add to its projected cable lines to Hawaii, Guam and the Philippines, a branch connection with the coast of Japan. It would be a gratifying consummation were the utility of the contemplated scheme enhanced by bringing Japan and the United States into direct telegraphic relation." The interest of the Japanese in the early settlement of this question is obvious, and there can be no doubt that the proposed cable would do much to strengthen the bonds of commerce and friendship between ourselves and the marvelously progressive people of Japan.

The next point in order is to settle how to go about the work. Mr. McKinley suggests that if Congress cannot devise a plan to encourage private enterprise, the Postmaster General be authorized to ask for bids, which we presume means a government cable. We should be very sorry to see the cable operated by the government, but are glad to note that bills are already introduced in Congress looking to the very early laying of such a cable or cables. One of the provisos is that the cable shall be of American manufacture and be laid by American ships, conditions that we venture to approve most heartily. If our domestic enterprise is not equal to the task, it will be time enough to go to Europe for the needed skill and material. There are rumors that cable interests abroad will seek to frustrate these plans, but there is no definiteness to the accusation, while little doubt can be entertained that Congress will, to paraphrase the remark of John Bright, insist on anchoring the New World and the Far East side by side. There are some things that are inevitable and must be done. This is one of them.

THE POLYPHASE MOTOR FOR ELECTRIC RAILWAY WORK.

Professor S. P. Thompson in his recent presidential address to the Institution of Electrical Engineers took up the cudgels for the alternating-current motor for electric railway work. Speaking of the use of alternating currents for transmission of power for electric railways, he says the extraordinary thing is that having gone so far, the complication is introduced of using rotary converters to work continuous-current motors, instead of employing the polyphase motor. The choice of the mixed system he considers of doubtful wisdom. The same thought has doubtless occurred to many others, for, from the technical side of the question, there is no insuperable obstacle to the use of the polyphase motor at the present day in certain classes of electric railway work, such as for elevated and suburban traction. For such work, the three-phase motor will operate at practically the same efficiency as the direct-current motor, and has the advantage of no commutator, the maintenance of speed in spite of moderate variations in voltage, and rendering possible the use of high voltages. The disadvantages, of course, are the necessity for at least two trolley wires, and lagging currents. The saving of copper inherent in polyphase systems will, however, in many cases balance the disadvantage from lagging currents, so far as affects line loss; and the inductive drop due to the alternating currents may, in part, at least, be compensated for. So far as the action of the polyphase motor itself is concerned, its direct-current rival now in possession of the field has no grounds for putting on superior airs, its only claim for superiority being due rather to adaptability to series-parallel connection with its mate or mates. With rheostatic control, the advantages are with the polyphase motor, and for service involving uniform speed with infrequent stops at stated intervals, this method of control is not disadvantageous. As such service also implies lines of considerable length, the high voltage of the polyphase system adds further strength to the argument. The reason why the polyphase motor has not been applied to any greater extent in electric railway work is doubtless a commercial one, arising partly from the reluctance of railway engineers to take a risk with an untried system, and from the dislike of manufacturers of standard direct-current railway apparatus to encourage the introduction of a new class of electric railway equipment.

DYNAMOS FOR THE SIMULTANEOUS GENERATION OF LOW-VOLTAGE DIRECT AND HIGH-VOLTAGE ALTERNATING CURRENTS.

There will be found on another page an answer to the editorial appearing in these columns in the issue of Nov. 11, criticising the proposition of Mr. Alton D. Adams to generate high-tension alternating current direct in a double-current generator. Taking up first the statement that it would not be desirable to generate 5000 or 10,000 volts for the alternating-current side of double-current work, but that 2000 volts would be sufficient, three cases of Edison stations working with combined alternating and direct-current machinery may be cited. Chicago is the one notable instance in this country where double-current generators are in use. The alternating current line pressure in this case is 4500 volts. Brooklyn is the notable pioneer case of alternating-current generation and transmission with direct-current distribution through underground mains. The pressure used there is 6600 volts. In New York City a transmission line has been installed by the Edison Company with rotary converters to both ends to ling two generating stations, with the idea that the rotaries and high-tension apparatus may eventually be used in connection with a central generating station on the water front. The pressure in use here is 5000 volts. Double-current generators as used so far for railway purposes transmit at 10,000 volts.

Admitting, however, that 2000 volts may prove a pressure sufficiently high for the alternating-current end of double-current systems, let us reduce to figures the claim made in these columns and disputed by Mr. Adams that it would prove difficult to provide insulation for the high voltage in the narrow and crowded slots of the double-current machines themselves. Taking for a working basis the direct-coupled 200-kw double-current machines of the Chicago Edison Company these have, as Mr. Adams cites, 21 slots per pole. They also have 20 poles, making a total of 420 slots per machine. Judging from recently published illustrations, the armature diameter is in the neighborhood of 5 feet, thus giving an armature periphery of about 16 feet. This gives about 26 slots and teeth per foot of periphery. The slots being crowded are necessarily deep, and if the width of the slot is equal to that of the root of the tooth, this width cannot be more than about one-quarter inch, or five-sixteenths at the most.

Assuming that Mr. Adams' proposed arrangement of direct-current winding in the bottom of the slot and altenating-current winding in the top of the slot were adopted, let us see what proportion of the total slot width would be required for the insulation of the high-voltage alternating-current winding. Alternating-current windings for 2000 volts are as a rule considered to require an insulation thickness of at least one-sixteenth inch between copper and iron, while three-thirty-seconds is considered betted practice. This would take out of our five-sixteenths to one-quarter inch slot half of its width, leaving (if a bar winding were used) only half the space for copper. But a bar winding could not be used in a 200-kw 2200-volt polyphase machine, and more insulation would be required between the wires, strips or ribbons—whichever were used. The result would be a reduction of the cross-section of the copper to one-third or one-fourth of the area of the slot.

To help these conditions somewhat it might be proposed to further reduce the number of the slots, but this is probably about a

minimum in the machines already constructed and referred to above, which have per pole only about one-fourth of the number of slots of the plain direct-current machines of the same output and speed standing immediately beside them. Mr. Adams states that a requirement for more room in slots simply involves increasing the diameter of the armature and the depth of the slots. This may be true of alternators or of what may be called normally designed machines in which the slot depth is not a very great percentage of the polar pitch. In double-current machines, however, the poles are near together and the slots are crowded and deep, so that an increased depth would cause serious magnetic leakage, the lines of force finding it easier to cut across the tops of the teeth, where they would be assisted by the armature reaction, than to force themselves deep down through the long teeth into the body of the armature iron. It must be remembered that double-current machines as they stand, generating simply alternating and direct currents in the same windings, are difficult and extreme designs, suffering many disadvantages which, if aggravated by further requirements, would make the machines impracticable.

The folly of the proposition to make a machine for this purpose with two separate armatures excited by one field may be pointed out by considering a slight further change of the machine. The space between the two armatures required for the end connections of the two windings would, of course, make the field-exciting coils quite uneconomical of copper and current. It would probably prove preferable to excite each of the two armatures from its own poles and field ring. In this case the machine would be divided into two separate dynamos, one generating direct and one alternating currents, coupled on the same shaft. The cheapest way to get up such a machine is to buy a standard alternator and a standard direct-current generator for the same speed and couple them together.

Provided the electrical difficulties could be overcome, the whole question resolves itself into one of first cost and efficiency. It is fair to assume that double-current machines with a single winding for low voltage and suitable for direct connection, would cost in moderate sizes about $25.00 per kilowatt. The transformers for stepping up their power might be estimated at about $5.00 per kilowatt. Assuming that only half the power is to be delivered on the alternating-current end, the cost of the transformers will be about 10 per cent. of that of the generating machine. The increased cost of the generating machine, if to deliver alternating current directly at the high pressure, would undoubtedly be more than 10 per cent. The average efficiency of step-up transformers of moderate sizes may be put at about 96 per cent. on Edison service where machines are kept fully loaded by means of storage batteries or are shut down. The 4 per cent. loss on half the output of the machine means a 2 per cent. loss on the whole output. The reduction of the efficiency of the machine, were it made to generate the alternating current at full high voltage, would undoubtedly be 2 per cent.

ELECTROLYSIS OF CAST IRON WATER PIPES.

An interesting article appears in another column, upon electrolysis of main water pipes in Kansas City. Prof. Blake supplies a number of measurements that are noteworthy, if only for the reason that they are precise measurements seldom forthcoming, and it is only from statements of this character that reliable conclusions can be arrived at. It is interesting to notice that the resistivity of the cast-iron is 56.5 times that of copper. It is fortunate that wrought iron has no such resistivity, or iron telegraph wires would have been impossible for long circuits. The measured resistance in the joints, as given in the first table of the article, are surprisingly uniform, considering the nature of the resistances. We assume, however, that the entries in the second table are successive measurements of one and the same joint, and not measurements of successive joints. joints.

The general conclusion to which the article leads is that a line of main water pipe has an electrical resistance many times that which would exist if the joints were electrically perfect; perhaps forty times as much. In one sense this is an advantage, because it means that the stray return current which a main will tend to carry, when in the neighborhood of a trolley system, will be forty times less than if the joints were perfect, and consequently the destruction of pipe by electrolysis at the end of the main where the current emerges, will be reduced forty times. In another sense, however, the fact is a disadvantage, because whatever current is diverted into the main is tempted to leave and re-enter around each joint, and so bring about electrolytic corrosion at all the joints, instead of at one end of the main only, just as plating vats connected in series produce electrolytic deposition in each and every successive vat.

It would seem to us that where the potential difference between the ends of such a water main is large, as might be due to a very imperfectly bonded return track in a trolley system, the disadvantage would outweigh the advantage, and the electrolytic corrosion produced all along the water main might be serious, owing to the relatively powerful current forced through it. On the other hand, where the trolley return system is so well bonded and connected that only a few volts potential difference can be found between any pair of points in the district, the advantage outweighs the disadvantage, and so little current can find its way into the mains by reason of the high-resistance joints, that the electrolytic destructive effects will be negligible.

In any case, however, whether the trolley return system is so good as to involve but a small possible potential difference in the district; or so imperfect as to leave a large difference of potential seeking a conducting path, it is clear that water mains should not be connected to the return busbar or return feeders of a trolley power house. On the contrary, the water pipes should be studiously left alone. In the first place the effective conductance they can afford to the hundreds or thousands of return amperes in a trolley system can be but trivial, owing to the resistances of their joints; and, in the second place, the electrolytic damage which is capable of being done at each joint by forcing a strong current through the pipes might be serious in the course of months or years.

We do not clearly follow Prof. Blake's reasoning as to the protection afforded by asphaltum coating. It would seem that any insulating paint applied to the buried pipes must tend to insulate them from the surrounding soil to some extent, and thereby lessen the corrosive influence of neighboring trolley return systems. The only question is as to the amount and duration of the protection thereby afforded. In the first place, the effect of such paint near the joints should increase their effective resistance by diminishing the conductance of the shunt paths around the joints. In the second place, it should increase the effective resistance of the pipe line as a whole. Consequently, a coating of insulating paint must tend to protect the water mains to which it is applied. But it is evident that no such paint can stop corrosion entirely, and that in no case can it prevent internal corrosion due to the electrical resistance at the joints.

The key to the whole question seems to be in the conductance of a trolley ground return system. Where the track bonding is good and the ground feeders are ample, the electrolytic danger to buried pipes disappears, but where the opposite conditions are present, the electrolytic destructive imp, like Banquo's ghost, will always hover at the feast.

The Proposed Underground Electric Road for New York City.

The most definite responsible statement yet made of a serious consideration of the question of bidding for the tunnel railway has come from Mr. H. M. Littell, who is connected with the banking house of J. & W. Seligman & Co., and is a well-known leader in street railway affairs. The men who will make the bid are organized as the National Street Railway Construction Company, which was incorporated shortly after the appointment of the Rapid Transit Commission, and is especially empowered to construct tunnels for the operation of railways. It is capitalized at only $5000, but has the privilege of increasing its capital at any time desired. That it is directed at the rapid transit tunnel seems evidenced by the fact that it has undertaken nothing during the three years since its incorporation, but has been content during that period to pay taxes while waiting.

One of the members of the syndicate said last week: "The National Street Railway Company has fully determined to make a bid for the construction and operation of the tunnel railway. We had intended to say nothing about the matter until we presented our bid on the morning of January 15, and it had been opened and made public by the Rapid Transit Commission, but since, in some inexplicable way, our intentions have been divined, it will be as well to make some authoritative, though partial, announcement of our plans. The active promoters of the undertaking have been studying the problem since 1893. In that year our company was organized with one of the most comprehensive charters ever granted to a corporation.

"The original promoters of the project are H. M. Littell, who will superintend the construction from the point of view of the probable future manager of the entire system; Fred W. Abbot, the civil engineer who constructed the great drainage tunnel for the City of Mexico, and who will supervise the excavating and general construction of the tunnel; Dr. Louis Duncan, who will have charge of all that relates to the electrical equipment and operation of the railway, and Mr. James P. McQuaide, of the National Conduit & Cable Company, who will supply much of the electrical material for the distributing system.

"They believe that they can make a low bid and yet obtain a fair profit. Some say the first section—the three-mile trunk line to Forty-second street—will not pay for a long time. We think it will pay at once. Mr. Littell has estimated that this first section will obtain at once 100,000 passengers a day, that in ten years the number will have increased to 500,000, and that by the end of the fifty-year lease it will be 1,000,000 daily. At that time the company will have the option of a re-lease for twenty-five years. The operating expenses, we are confident, will not exceed 50 per cent. of the gross receipts.

"Our financial arrangements have all been made. At the head of the financial syndicate is the president of one of the foremost national banks in the city. Another member is one of the greatest steel manufacturers in Pittsburg. With them are associated friends of theirs. Neither the Metropolitan capitalists nor those of the Third Avenue Railroad have anything whatever to do with our company or syndicate."

Movements in the Independent Telephone Field.

At Cleveland, O., on Dec. 6, at a meeting of the capitalists interested in the Federal Telephone Company, it has been decided to cooperate with the Telephone & Telegraph Company of America as soon as the lines of the latter company have been constructed westward to the borders of Ohio. The east is not developed nearly as completely as the middle west, it is said, and according to President Henry Everett there will be no consolidation until the eastern people extend their system to the borders of Ohio. "We shall go ahead and develop the state of Ohio," said Mr. Everett, "as we started out. We will inform the eastern people that when their lines reach this state we will be very glad to co-operate with them."

Articles of incorporation were filed last week with the New Jersey secretary of state by the Seashore & Delaware River Telephone, Telegraph & Cable Company. The company is part of a system to be established by the Telephone, Telegraph & Cable Company of America, and is capitalized at $100,000. The company will build a telephone line beginning at the foot of Morgan Street, Jersey City, and through Jersey City, Bayonne and Elizabeth, and along the Atlantic coast to Atlantic City and Cape May, and thence to Camden. The incorporators are James E. Hayes, Camden; George W. Beers, Fort Wayne, Ind., and John B. Stauffer, Philadelphia.

Mr. Samuel Ross, president of the Washington Telephone & Telegraph Company, has sent a letter to the chairman of the Committee on the District of Columbia informing him that the Washington Telephone & Telegraph Company has been formed, and that it was proposed to give a first-class metallic circuit service, with unlimited calls, at the rate of $48 per annum for a business and $36 per annum for a residence service. These rates mean less than 10 cents a day for a residence, and a little over 13 cents a day for a business house. A bill will be presented in Congress asking a franchise enabling the company to do business in the District. It is the purpose of the company to go before Congress with contracts signed by Washington business men and others so that it may be able to demonstrate the fact that this franchise is desired by the public.

The Bell Telephone Removal to New York.

The proposed removal of Bell telephone interests from Boston back to New York, the city they left about twenty years ago, is naturally giving rise to considerable discussion in the capital and state of Massachusetts. The aspects of their situation are well brought out in the subjoined item from the Boston News Bureau: "When the legislature of Massachusetts decreed that the growth of the telephone in the United States should be limited by the amount of capital the Massachusetts legislature was pleased to permit to it; when it decreed that the legislature could dispose of the premium upon Bell Telephone success; when it in effect decreed that the extension of the long-distance telephone system from Chicago and St. Louis should, in a measure, be dependent upon a stock auction room in Boston, the News Bureau pointed to this as so-called granger legislation, which would eventually drive the Bell Telephone Company from the state of Massachusetts. The esteemed Boston *Herald* laughed at the idea, and declared the fear was groundless, that the Bell Telephone Company would never step from under the protection of Massachusetts laws. Now the official announcement has come, and the Bell Telephone Company's assets are passing from Massachusetts to New York, and the Boston *Herald* denounces the whole outfit and declares telephone shares no longer a conservative investment, but 'an ordinary Wall Street security and semi-speculative.' Is the esteemed *Herald* aware that the New England Telephone Company which certainly furnishes a very conservative investment, has for a long time been a New York corporation? We would also like to ask, Is the conservative character of the Chicago, Burlington & Quincy management in any way diminished because the company's shares are traded in by Wall Street? It is, however, quite proper that the same pen which defended the most unjust action of the state of Massachusetts should also be the one to cast an aspersion upon the best class of investments Boston brains have ever furnished to New England investors. The Bell Telephone Company does not remove from Massachusetts that it may pay its stockholders bigger dividends. It removes from Massachusetts that it may raise its capital by the sale of new shares for the extension of the telephone system of the whole United States without being hampered by senseless and most unjust restrictive legislation in Massachusetts."

With regard to the transfer of the property of the old company, it is said that counsel for the American Bell Telephone Company have made thorough investigation of the state laws relating to taxation and give the opinion that stock of the Long Distance Company is exempt from taxation under Massachusetts laws. An indenture has been executed under which bonds of the American Telephone & Telegraph Company may be issued, and it is probable that a bond issue will figure in the new telephone scheme. At present Bell officials are unwilling to give details concerning it. The indenture calls for 5 per cent. bonds. It is said that the proposed American Telephone & Telegraph Comany bond indenture is for $100,000,000 bonds. The Old Colony Trust Company is registrar. The provision for such a bond issue is taken as an indication that the Bell telephone interests are looking ahead, and that the company proposes to be in position, so far as capital is concerned, to secure complete control of the entire telephone business of the country at the proper time.

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The Newport, R. I., Electrical Automobile Station.

BY SPENCER C. CRANE.

We believe it is a fact that the Newport plant of the New England Electrical Vehicle Transportation Company was the first in this or any other country from which automobiles were "let" to any person who desired them, with or without drivers.

The problem to those in charge of this plant was one in which precedent and experience were but small factors. From the beginning to the end, it was a case of new problems that must be solved by new solutions. At the start there were three widely differing factors to be brought into harmony; namely, an empty carriage and horse barn, the summer colony and the automobiles.

The horse barn must without change be made to accommodate the automobiles, their batteries and charging apparatus.

The summer colony must be taught proper care in handling the carriages. Their co-operation must also be secured in preventing reckless driving, and their assistance in having the cross-walks and roads improved by the city.

And lastly, methods of repair and inspection must be worked out, that would keep the repair bills down, and make the plant a paying investment.

As soon as the first automobile arrived, the electric light wires were tapped and run to the automobile station, where, with the assistance of a barrel and two stove lids, a rheostat was improvised for charging, until the arrival of the switchboard. Then the automobile was at once put upon the streets, and kept making the rounds of the fashionable quarter, with the result that within a week all of the ten carriages that had arrived were engaged by the month, and a waiting list of customers started. Not once during the summer was one of the twenty carriages that arrived later idle; in fact, at one time there were thirty names on the waiting list.

So thoroughly and successfully were the carriage introduced that notwithstanding Dewey Day and the yacht races at New York, the regular customers held their carriages till the middle of October.

The switchboard, which the contractors promised early in June, did not arrive till the first of September. In the meantime temporary rheostats were improvised by using eight coils of No. 12 galvanized iron wire and large porcelain insulators.

The charging was done by means of plugs, which snapped into sockets inside or under the carriage body. One of the terminals of the plugs was larger than the other, which made it impossible to connect the wrong polarities. When the plugs were not used for charging they were raised above the attendants' heads, but within reach, by means of weights and pulleys, as shown in Figs. 2 and 5.

As more of the carriages arrived it was found impossible to care for them during the day only. It was also clear that some systematic routine of care must be given them. After some experimenting the following routine was adopted as best filling the severe requirements of such a plant:

1. When the carriages were brought in for the night they were immediately washed. 2. They were then taken from the wash-stand, sponged, chamoised, and polished by their drivers. 3. The carriage was then run to its night berth for inspection and charging. 4. Before being charged the rear axle was jacked up and both rear wheels taken off, and balls and cones examined and oiled before the wheels were returned. 5. Commutator and brushes examined and cleaned. 6. All bearings examined and oiled. 7. The combination meter examined while wheels were being run clear of the floor to see if the normal amount of power was being consumed. 8. The brake tried to see if both wheels stopped together. 9. Gong and lamps examined. 10. Jacks removed from rear axle and charging plug inserted. 11. Steering gear tried and examined. 12. When fully charged a large card with the word "Charged" is placed on the carriage in a conspicuous place. 13. In the early morning the tires were inflated while the carriage was still in its night berth. 14. A running test of the brakes in the yard. 15. "Charged" card is reversed, showing the word "Ready."

The carriages were delivered and returned by us at any hour of the day or night. The heaviest call for delivery was at 9 in the morning, and for returns at 10 at night, though quite often the last carriage was not in till 6 the next morning.

FIG. 1.—READY FOR SERVICE.

At any time after 7 in the morning a procession of carriages could be seen leaving the station and distributing itself in every direction at the residences of the different customers. In the rear of the procession was the "pick-up" wagon, driven by Mr. Hayward, who made a circuit of the destinations of the various carriages just delivered in order to get back the various drivers, who concentrated at agreed places in order to shorten the circuit.

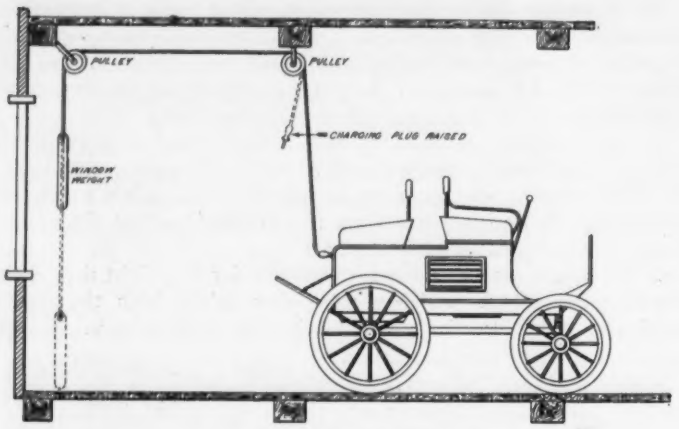


FIG. 2.—CHARGING BATTERIES.

The "pick-up" wagon then returned to the station loaded with the drivers, who were ready for the next delivery. Usually seven carriages were delivered at one trip, though as many as ten have left the station at one time.

Most of the carriages were not seen again until they were returned during the night, when they were brought in reversed order of morning delivery.

Considerable trouble was experienced by the drivers entering the station at a high rate of speed. This was liable to lead to serious accident, as a sharp corner must be turned in entering, as a carriage was usually on the washstand, but a few feet from the entrance, especially at night. Threats and discharges seemed to have but temporary effect on the speed in entering. Finding these methods failures, it was decided to try a block signal consisting of a red and white lamp, manipulated by a double-throw switch operated at the washstand. The operation of the signal was as follows: As each carriage entered the station courtyard it rang its bell and came to a full stop until the lights gave an answering "wink" from the proper lamp. The answering "wink" prevented accidents from someone forgetting and leaving the white light burning, after a carriage had been put on the washstand.

The signals were as follows: Red "wink," "stay out;" red "wink," then white, "come in slowly;" white "wink," "all clear." From the time that these signals were first placed in operation no further trouble was experienced.

As the number of carriages increased it was found that by pumping up the tires to the required pressure by hand cost $2.40 a day, or $876 per year for air. This expense was quickly disposed of by installing a General Electric motor, connected by belt to a Knowles air compressor. Between the pump and motor was the storage cylinder, where the air was held at 140 pounds to the square inch.

The urgent need was also felt for some cheap device for taking the batteries out of the carriage body and returning them. We found upon investigation that the trouble with most devices of this character lay either in high investment cost or in the difficulty of lining the carriage accurately with the changing apparatus, unless a design was adopted which could handle the weight of the entire carriage and consequently cost far beyond what the small plant could afford. The result of our investigation led us to the building of a strong truck with wide wheels swiveled in front, as shown in Figs. 6 and 7. On top of this truck was placed a turn-table which would exactly meet any

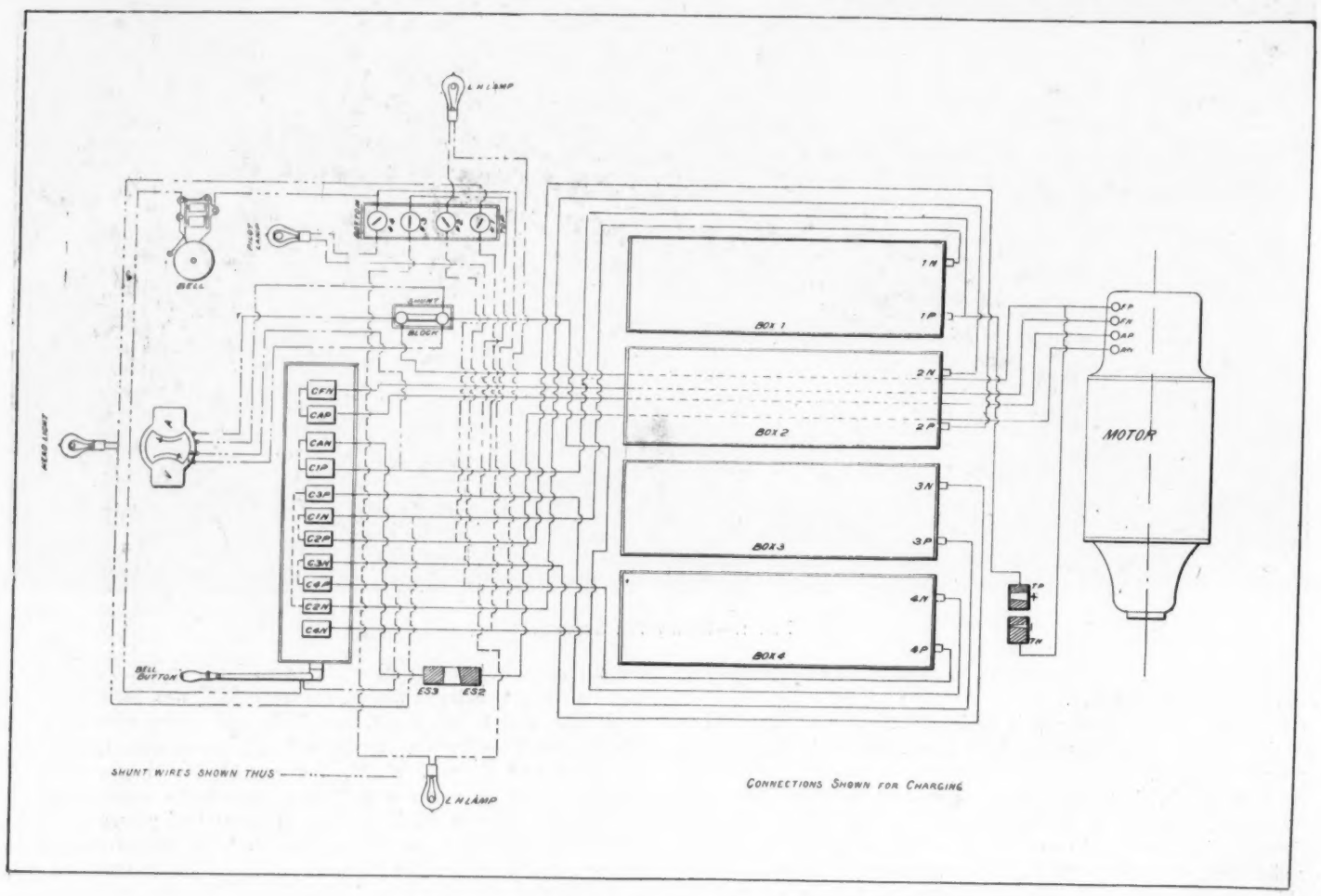


FIG. 3.—WIRING DIAGRAM OF LADIES' VICTORIA.

angle of the carriage. On the turn-table were mounted the rollers and the withdrawing apparatus, which consisted of a bicycle chain having on the end a snap which caught into a hitching ring screwed on the front of the battery boxes. The upper end of the chain was made fast to a simple positive clutch mounted on a hand rotated shaft. These clutches were thrown in or out as one or more of the four battery boxes needed to be withdrawn. To accommodate the

varying heights of the carriage from the floor as each battery box was withdrawn, or the mounting of the carriage springs differed, a lever was placed under the turn-table which, by means of a hand screw on the rear of the truck, was raised or lowered, which in turn moved the front of the turn-table up or down. The side motion of the turn-table was handled in the same manner, but with a lighter screw.

As these "loaders" were a "battery truck" and a loader combined, the battery could be pulled without further trouble to any part of the building; or the battery could be withdrawn from the carriage at any convenient place, as the whole apparatus was portable. The batteries are returned to the carriage by simply pushing them back by hand, aided by the slight angle furnished by the loader.

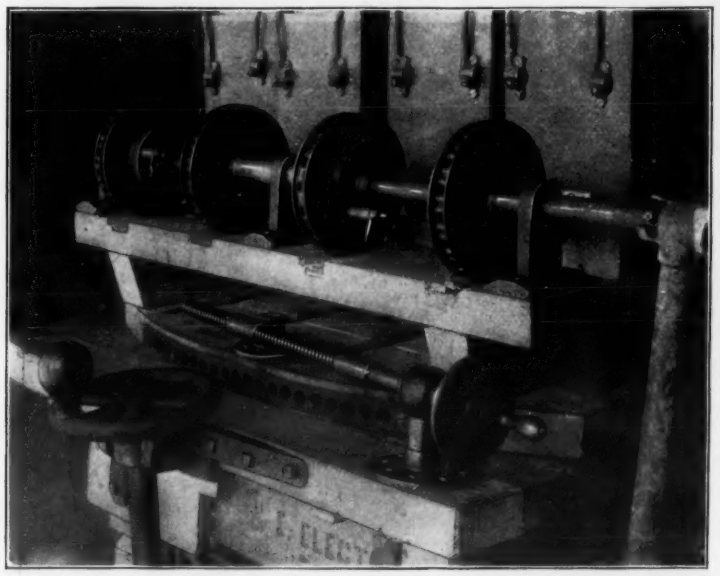
Great trouble was also found in removing the wheels from the rear axle (which turns with the wheel) of one of the types of vehicles, which was disposed of by a wheel extractor of simple design, consisting merely of a pair of yokes and a screw of large leverage.

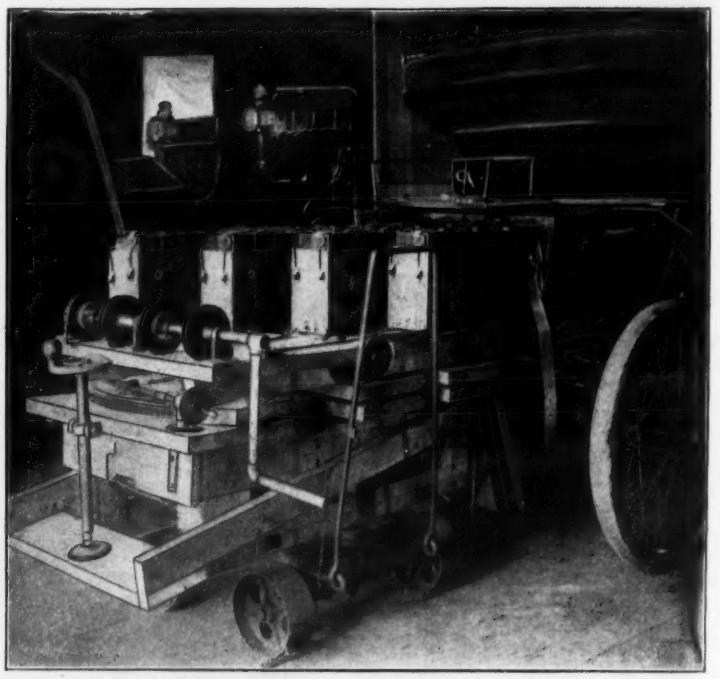
The first thing an engineer wishes to know of an automobile is, does it work well; and, second, what is the cost of repairs? As the second consideration is so closely allied to the first, special efforts were made to find the cost of repairs to the different parts; also averages of the cost of repairing such parts as most often require it, such as changing tires or repairing broken battery lugs. To accomplish this, time cards were used, each containing the date, the style and number of the carriage, the part repaired, what was done to it, the material used and, if possible, the cause of the trouble and the conditions of the part before it was repaired. On the back of the card, the one or more workmen who helped on the job sign their names, and put opposite the time they started and time they stopped.

The rate per hour being known, it is an easy matter to find from the cards the labor cost, as well as that of the material. Each day these cards are gathered, and the total sum of each job put on the general daily repair report, from which curves of the various costs of parts are plotted, showing the comparative costs of the same parts of different styles, and just where it would pay the best to spend money on improvements. By this means the quick, accurate workman is picked out with certainty, without his personality having any bearing on the case.

As there are so many small parts to an automobile, and so many different styles of automobiles, it was soon found necessary to build a stock rack so that the workmen could immediately find the required part of the required style of carriage. To meet this demand, a rack was built with the horizontal shelves of each tier representing one carriage style. These were divided and subdivided into small compartments, plainly and clearly marked. The more expensive articles, such as hydrometers, etc., were placed in pockets that could be locked.

FIGS. 4 AND 5.—AN AUTOMOBILE STABLE.





FIGS. 6 AND 7.—APPARATUS FOR REMOVING AND REPLACING BATTERIES.

The "Dos-a-dos" vehicle (Fig. 8) was a popular one for families, parties and picnics, and was found to be most useful for out-of-town parties who wished to make the circuit of the cottages and Ocean Drive. These vehicles at times carried as many as ten persons, which was certainly an outrageous overload, but without apparent strain. Owing to their strong build, they were used for a "pick-up" and emergency wagon. The weight of this carriage with batteries is about 2500 pounds, the speed ten miles an hour, and a recorded mileage of 37 level miles. The occupants, of which there are four, are seated back to back; between the seats is a wicker basket for packages or lunch, and on the side a golf bag.

The Stanhope phaeton (Fig. 10) was popular with the ladies and middle-aged people who desired a vehicle provided with raised top and "boot" which made it rain-proof. This vehicle was mostly used for long runs, and it had a recorded mileage run of over 39 level miles at a speed of 12 miles an hour. The weight of this vehicle with battery is about 2200 pounds. There are seats for two in the front, and an additional portable seat can be placed behind for a footman.

FIG. 8.—DOS-A-DOS TRAP.

FIG. 9.—GENTLEMEN'S RUNABOUT.

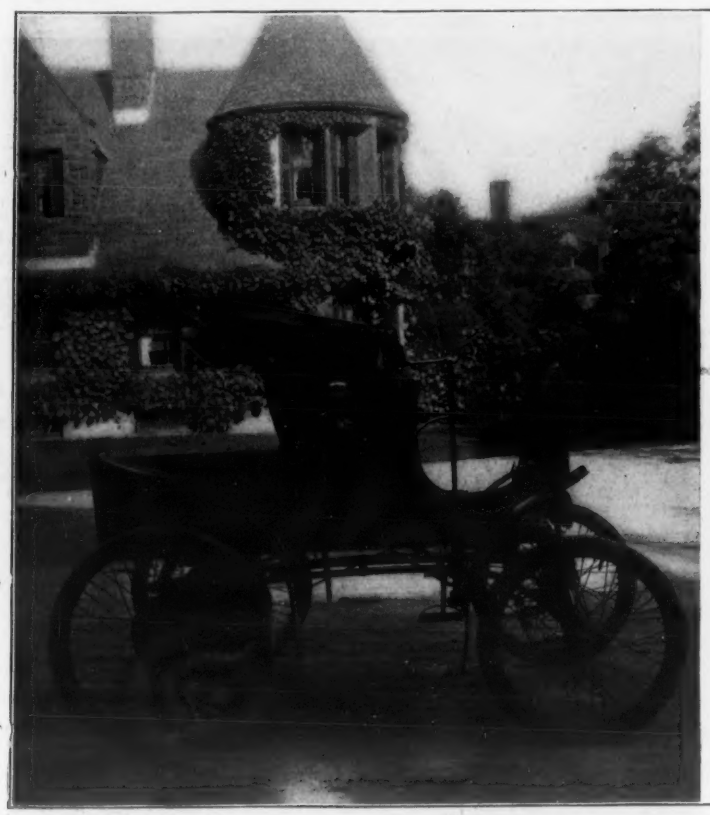


FIG. 10.—STANHOPE PHAETON.

FIG. 11.—LADIES' VICTORIA.

The "Ladies' Victoria" and "Gentlemen's Runabout" were the most popular vehicles in Newport, and were principally used by the younger set, presumably because of their stylish, attractive appearance, combined with their higher speed. The "Ladies' Victoria" (Fig. 11) is trimmed and partially painted red, and furnished with a high, sloping dashboard of elaborate design. The "Gentlemen's Runabout" (Fig. 9) is practically the same as the victoria with the exception of the curved design, which gives way to angles and lacks the "lazy back" and high dashboard. Though they are painted entirely black, they had a natty, jaunty appearance that created a demand far beyond our supply.

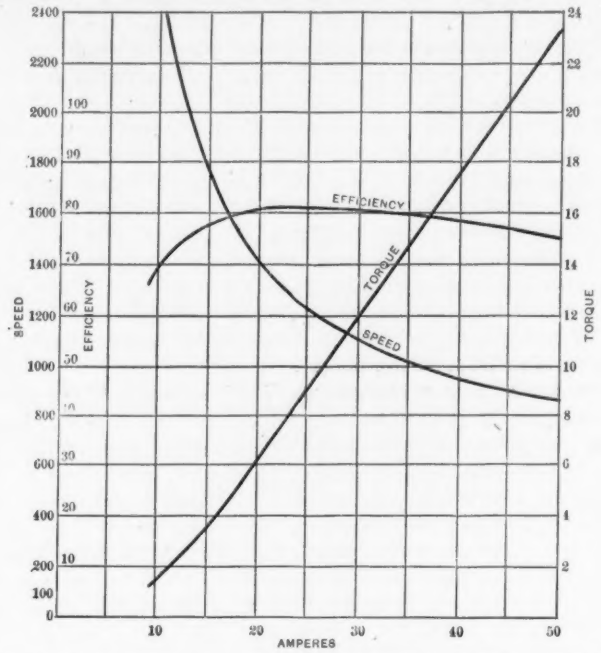


FIG. 12.—TORQUE, SPEED AND EFFICIENCY CURVES OF EDDY AUTOMOBILE MOTOR.

All of the above carriages have their batteries located in the rear, were supplied with electric sidelamps and headlights, and all were equipped with one motor and balance gear.

It seems proper here to mention the fact that during the whole season, notwithstanding the continued abuse and extraordinary overloads that were placed upon all these motors, that not one armature or field or commutator was lost from any cause whatsoever. In fact, the only electrical repairs that were made on any of

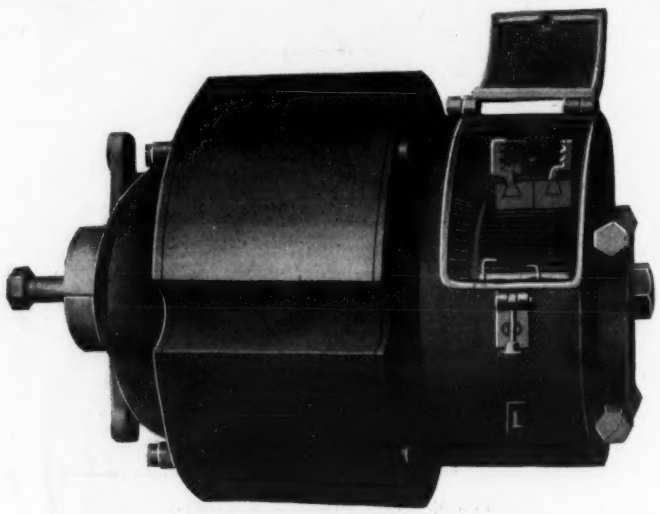


FIG. 13.—EDDY AUTOMOBILE MOTOR.

the motors were two pieces of insulation burned out that were placed between a brush holder and the frame of the motor. Those that are familiar with electric railway work will appreciate what a remarkable record these motors have made for themselves.

It seemed as though there was nothing that an automobile could be made to do that our customers did not try. Among a few of the many queer happenings that I remember, was the putting of a safety plug in when the customer, for some reason, had placed the controller on the full speed notch, with the result that the automobile nearly went through the side of a customer's barn. Again, while at a picnic, one of the customers ran a small low runabout through a huge bonfire. Another raced down hill backwards, and while going at over twenty miles an hour, reversed his motor with the result of making the carriage turn a complete somersault. Still another became confused in backing up a sharp incline, and for some unknown reason jumped from the wagon without taking out his safety plug. As he jumped his coat caught on the speed lever and started the machine ahead at full speed. The machine first rammed Mr. Vanderbilt's steam carriage, and after having disposed of its steam rival, it made for Mr. Winthrop's gasoline machine, which it just grazed, and ended its career by going down eleven stone steps to the wine cellar of the Golf Club. It took three hours to get this machine above ground; yet aside from the repairs to the dashboard, it was ready to go into commission in an hour.

Often the emergency wagon was called out by a carriage that was supposed to be disabled. On arriving at the scene after perhaps a five-mile run, it was found that the customer had forgotten to put in his emergency plug. On the other hand, it certainly was to the credit of these same customers that not one horse runaway during the season was caused by them.

It was also a noteworthy fact that many of our customers were rabid horsemen at the beginning of the season. I have heard them depreciate automobiles in no uncertain terms. The best they could say was that they were good enough as toys, yet long before the season was over not one of these had a word, except of genuine admiration; and this was not brought about by argument on the part of the management, but by the uniformly good service in speed, mileage and reliability of the automobiles themselves.

Torque, speed and efficiency curves are given in Fig. 12 for the Eddy motors of the vehicle shown in Fig. 11, one of which is illustrated in Fig. 13. The wiring diagram of the same vehicle is shown in Fig. 3.

The Central Station of the Imperial Electric Light, Heat and Power Company, St. Louis.

In a paper read before the Engineers' Club of St. Louis, and printed in the *Journal* of the Association of Engineering Societies, Mr. H. H. Humphreys describes in detail the design and construction of the direct-current lighting plant of the Imperial Electric

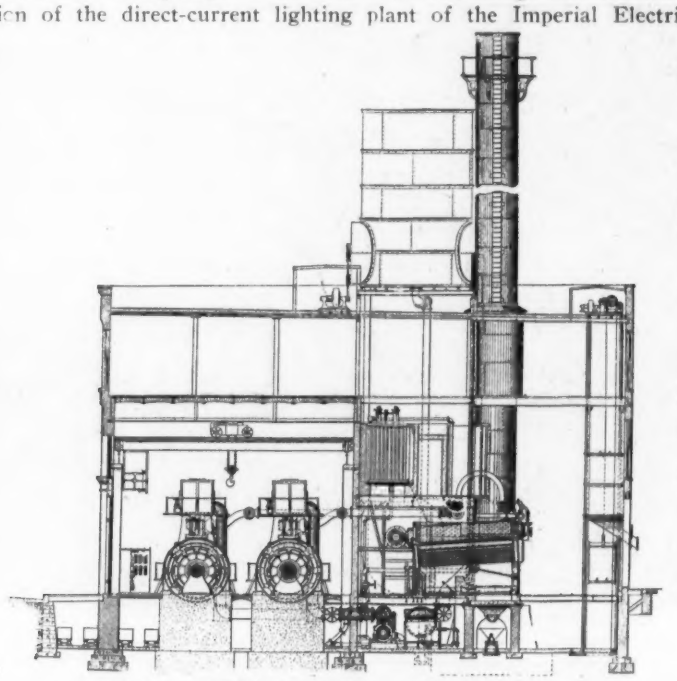


FIG. 1.—SECTIONAL VIEW OF THE STATION.

Light, Heat & Power Company, of St. Louis. Owing to the many interesting features of the plant, we give below an abstract of the paper:

This plant was intended primarily to compete in the district of St. Louis where underground distribution is employed entirely. The class of service to be supplied consists largely of 500-volt direct-current motors as well as some 220-volt motors of smaller size. Another important part of the service was to be arc lighting by means of en-

closed arc lamps, and the furnishing of incandescent light was by no means of secondary importance. In order to reduce the first cost of the station equipment and underground work, it was deemed advisable that all three kinds of service should, if possible, be supplied from one source delivering its output through one underground duct and one service cable. These considerations led to the adoption of the 440-220 three-wire direct-current system of distribution, employing 220-volt incandescent and arc lamps on both sides of the three-wire system, and 440-volt motors connected directly across the outside wires. The selection of the 220-440-volt system over the 110-220-volt system involved a saving in copper alone in the district covered by the plant, equal to half the cost of the building and the entire station equipment.

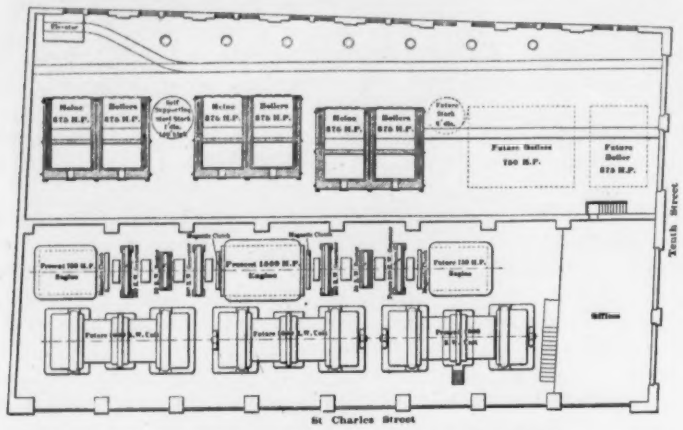


FIG. 2.—PLAN OF ENGINE AND DYNAMO ROOM.

Fig. 1 gives a sectional view of the building and Fig. 2 a plan of the engine and dynamo room. There are four Heine boilers arranged in batteries of two each, with one smoke pipe between them and economizers in the rear of and above the boilers. Each boiler has a rated capacity of 11,250 pounds of water per hour with feed water from the economizers at 200 degrees Fahr., and a pressure of 170 pounds above the atmosphere. The boilers, moreover, are guaranteed to be capable of developing continuously a capacity one-third greater than the rated capacity, and to have an efficiency of 70 per cent. at any load between rating and 20 per cent. above. At present one chimney is erected, its inside diameter being 7 feet and its height 140 feet above the street level. The chimney is of steel, self-supporting and unlined.

In order to counteract the effect of the economizers in cooling the gases from the boilers and permit crowding when necessary, the mechanical draft system was installed. The fan is placed directly behind the chimney and between the two batteries of boilers, being driven by means of a direct-geared electric motor designed to be operated at different speeds on either a 235 or 470-volt circuit. This motor is controlled automatically so as to maintain the steam pressure practically constant, a regulator slowing down the motor as the steam pressure rises, or increases its speed as the pressure falls. The capacity of the fan is sufficient to handle the waste gases from all four boilers and furnish a draft equal to one inch of water at the point where the gases leave the boilers. In emergencies it can be speeded sufficiently to give a draft of 1½ inches on all four boilers.

Two Green fuel economizers are installed, each capable of a regular and continuous capacity of 45,000 pounds of water per hour through 100 degrees Fahr. when receiving the water at 110 degrees Fahr., and with a temperature of the escaping gases at the boilers of not less than 450 degrees Fahr. Dampers are provided for sending the gases from the boilers either past the economizers and directly out the chimney; or through the economizers and then up the chimney; or through the economizers to the mechanical draft fan and thence up the chimney.

The coal or ash handling plant is of simple and economical design, consisting of a system of cars, tracks, elevator and overhead ash bin. The ashes are dumped from metallic hoppers under each boiler into small cars which are pushed by hand along the track to an elevator, which carries them up to be dumped into an overhead ash bin from which the ashes run by gravity into wagons in the alley.

The coal is stored in the basement under the front of the boilers, whence it is taken in the same cars mentioned above, hoisted on the elevator and distributed on tracks over the entire length of the boiler room in front of the boilers.

There are now in operation two Williams vertical, two-cylinder, cross-compound, condensing, automatic cut-off engines, built by William Todd & Co., Youngstown, Ohio. One of these is of 750 indicater horse-power, direct connected to a 500-kw generator, and is operated at a speed of 150 r. p. m. when supplied with steam at 170 pounds, and exhausting into a vacuum of 24 inches. The second engine has a capacity of 1500-hp. The heavy flywheels are located between the A-frames supporting the high and low-pressure cylinders. Each engine is so constructed as to be capable of operating continuously at double its rated capacity, and for short intervals at one-third above this double capacity. The excess capacity is obtained by admitting live steam into the receiver or low-pressure cylinder. The engines are provided with shaft governors controlling the valves of the high-pressure cylinder and capable of varying the cut-off from 70 per cent. of the stroke to a valve of 3-16 inch.

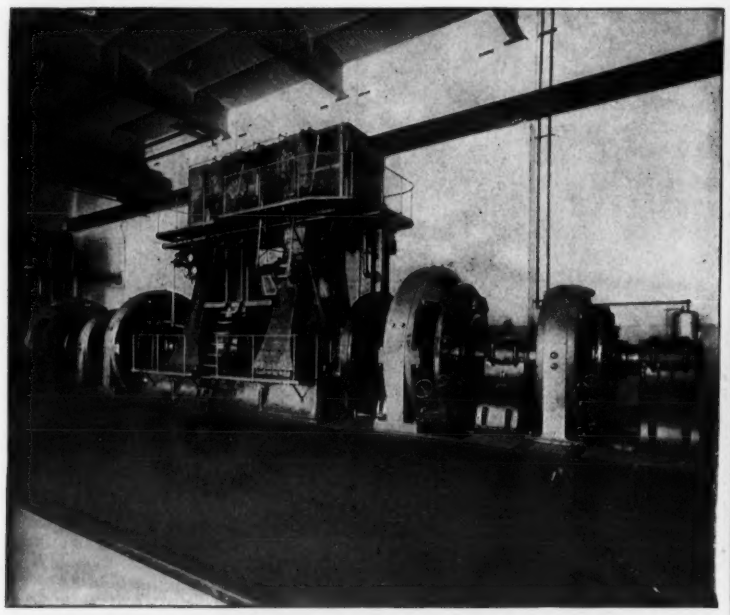


FIG. 3.—GENERAL VIEW OF ENGINES AND GENERATORS.

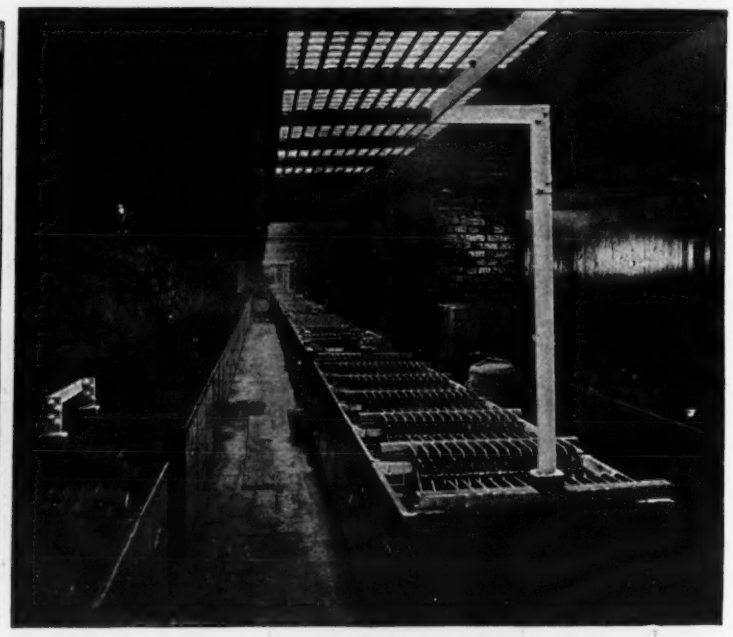


FIG. 4.—THE STORAGE BATTERY.

The governor is also fitted with a special speeding device by means of which the engine may be brought to the same rate of speed whether under friction load or full load. The drop in speed is guaranteed not to exceed 2½ per cent. under constant steam pressure from no load to one-third above rated load. This guarantee also covers a variation of steam pressure between 160 and 175 pounds with constant load. The variation of speed will not exceed 3½ per cent. with the combined changes in load and steam pressure above specified, either with or without the vacuum. When running at about 170 pounds pressure at the throttle and under constant load

at the rated capacity at 150 r. p. m., the engines are guaranteed to consume not more than 15 pounds of water per indicated horse-power hour. A second 1500-hp engine, designed and built by the Lake Erie Engineering Works, Buffalo, N. Y., has just been installed.

The condensing plant consists of a Worthington surface condenser, a Worthington cooling tower, two combined air or feed pumps and two circulating pumps of the rotary type. The rated capacity of the cooling plant is 33,750 pounds of steam per hour, but it will take care of overloads up to 49,500 pounds per hour, with but a slight reduction in vacuum. It is guaranteed to produce a vacuum of not less than 22 inches at the rated work, and under the worst conditions of service; 25 inches under fair and average conditions, and 26 inches under the best. The cooling tower is located on the roof and is 18 feet in diameter and 29 feet high. Its cooling surface is composed of galvanized iron pipe cylinders. There are dupliacte fans at opposite ends of the same shaft drawing air into the tower, these fans being driven by a belted motor on the top of the building. All of the boiler, feed, circulation and air pumps, the elevator, fans, etc., are driven by electric motors. Steam is used only in the large cylinders of the compound condensing engines, and it is estimated that a saving of about 10 per cent. on the entire output of the plant is realized through the exclusive use of electrically-driven auxiliaries.

The engines and generators are connected by means of the Arnold system of power transmission, consisting of quills and internal shafts with double bearings, connected by magnetic clutches.

The generators are connected to the engines by means of magnetic couplings so arranged that either intermediate generator or booster may be disconnected from one engine and connected to the other while all are in motion. When it is desired to start up the generator it is brought up to speed as a motor and then connected to the engine by the magnetic clutches.

This arrangement makes it possible to drive any one, two or three of the generators, and either one or both of the boosters mentioned later on, from the large engine in case of accident to the small engine. Two generators and one booster may also be handled by the small engine in case of accident to the larger one.

The engine room is spanned by an electric traveling crane, shown

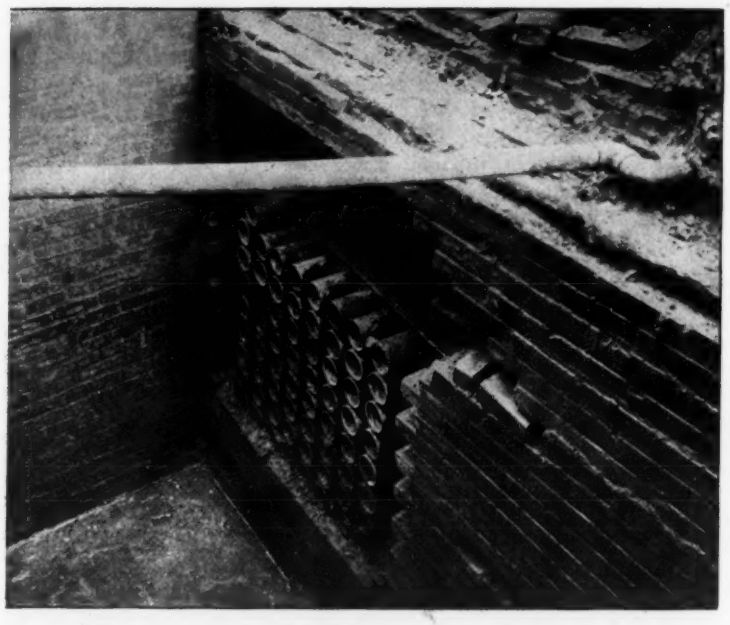


FIG. 5.—AT A MANHOLE OF THE UNDERGROUND SYSTEM.

in Fig. 3, with independent motors on the lifting, traveling and transfer motions. The capacity of the crane is 15 tons at 10 feet per minute, and it has a maximum speed of 30 feet per minute at lighter loads. The maximum speed of travel is 80 feet per minute, and the maximum transfer speed 40 feet per minute. The motors are of 20, 15 and 5-hp, respectively, and were designed by the manufacturer as a part of the crane and built substantially into the framework of the structure.

There are three 500-volt constant-potential generators built by the Siemens & Halske Electric Company of America. They are of the internal ironclad-armature type, and were designed specially to fit the system of power transmission adopted. The field frames may be slid parallel to the shaft a sufficient distance for removing the armature for repairs. The capacity of each generator is 500-kw at 525 volts when operated at 150 r. p. m. At this rating the rise in temperature of the armature will not exceed 40 degrees C.; of the field 35 degrees C., and of the commutator 50 degrees C. The generators are guaranteed to have an overload capacity of 25 per cent. for two hours and 33⅓ per cent. for one hour, and to stand a 50 per cent. momentary overload without injurious sparking. They will not flash at the commutator when the circuit breaker opens at 50

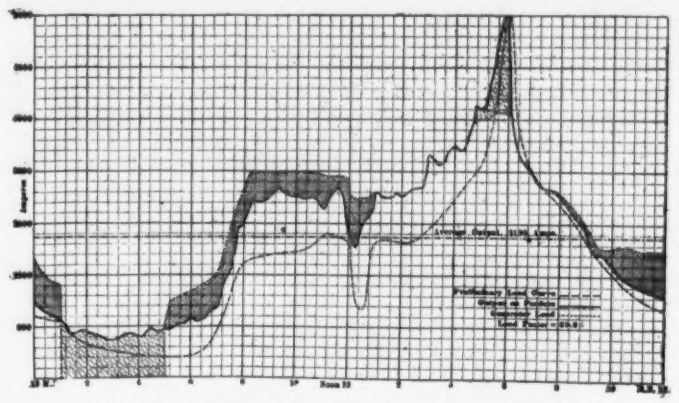


FIG. 6.—PRELIMINARY AND ACTUAL LOAD CURVES.

per cent. overload. The carbon brushes are proportioned for 25 amperes per square inch of contact, with rated load. The insulation resistance between the conductors and frames was specified at 1 megohm. The guaranteed efficiencies of the generators are 88 per cent. at one-quarter load; 99½ per cent. at half load; 93½ per cent. at three-quarters load; 94 per cent. at full load, and 93 per cent at 25 per cent. overload.

There are two separately excited shunt-wound boosters each of 50-kw. capacity at 150 r. p. m. and capable of carrying 500 amperes and delivering any voltage from zero to 130 volts.

There are 280 cells of storage batteries supplied by the Electric Storage Battery Company, and each containing 13 positive "Manchester" plates and 13 negative "Chroride" plates. These are contained in lead-lined wooden tanks which are supported on large porcelain insulators. The elements themselves in each cell rest upon heavy glass plates and are separated from each other by glass tubes. The capacity of this battery is 200 ampere-hours at a discharge rate of 250 amperes, and it is capable of maintaining a maximum discharge rate of 1000 amperes for one hour, and to give a discharge of 500-kw for one hour without a drop in pressure below 1.7 volts per cell. The normal charging rate is 250 amperes, and the maximum charging rate 350 amperes.

The battery is located in the basement, partly under the engine room and partly under the sidewalk, in a cool, well-ventilated room. The floor is composed of vitrified tile laid in pitch upon a concrete base. There are four end-cell regulating switches located in the battry room, each of 600 amperes capacity with points for connecting 50 end cells. Each switch is provided with a motor and gearing which are operated from the battery panel of the main switchboard, the position of the contact switches being shown at all times by end-cell indicators on the switchboard. Each motor is capable of handling the two end-cell switches on each side of the circuit, although in practice the two are operated in multiple during times of heavy discharges.

There are four bus bars on the switchboard—one high positive, one low positive, one high negative and one low negative. There are also positive and negative charging buses. Each of the ewo end-cell switches on each end of the battery may connect to either the high bus or low bus or to the charging bus. The two boosters of the plant may each be connected either between the high bus and charging bus, low bus and charging bus, or between the low bus and high bus, on either side of the system. The boosters may be connected in series either between the low positive bus and neutral or between the low negative and neutral. These combinations provide for charging the battery under all conditions of service, and at the same time maintaining it on the line as an equalizer of pressure. Either side of the battery may also be either completely disconnected or the entire battery cut out of service and the remainder of the system maintained by means of the two boosters connected toegther in series, and operating between a neutral and either side of the system.

The value of the storage battery as an equalizer of pressure and

as an auxiliary to the steam plant is universally admitted, and it has proved indispensable on many occasions in this plant. Its readiness to take all burdens thrown upon it, whether from an accident to the plant, a short circuit in the underground cable or a sudden demand for light caused by a thunder storm, needs only, it is stated, to be experienced in order to be appreciated.

The underground system consists of three-inch cement-lined pipe laid on 5¼ inch centres, with one inch of cencrete between the pipes and three inches surrounding the entire group. All ducts are laid to drain to manholes. The top layer of ducts enters service boxes, which are of two sizes, 3x3 feet, and 3x4 feet. These boxes are placed at the most convenient points for reaching customers, and their depth is governed by the depth of the conduit at each location. The manholes are located at every street intersection and elsewhere where necessary. They are of three sizes, 4x4 feet, with nine-inch walls; 5x5 feet, with nine-inch walls, and 8x8 feet, with 13-inch walls. Their depth is 6 feet 6 inches in the clear under the roof.

The conduits, as a rule, occupy every other street in each direction. They were laid out with the object in view of being able to reach one end of every alley in the city with a distributing main. When finished the conduit system will have 23 feeding points. The entire distribution system consists of two ducts providing one conduit for a three-conductor and an extra duct for city lighting or other service in the future. The feeder cables have all the same carrying capacity, notwithstanding the fact that some are nearly twice the length of others. The object of this is to economize conduit space and cost of cables by using the largest cable that can be conveniently pulled through the duct. Provision is made at the plant for keeping the pressure on the ends of all these feeders approximately equal, regardless of the length and the variation in drop, by running different voltages at the switchboard.

The system of mains consists of three-conductor cables of three different sizes. The rubber tape surrounding each conductor was made of a distinguishing color for convenience in connecting. The lateral service cables connecting from the underground mains to the basement of the customer's building are similar in design to the three-conductor mains, differing only in size and variation in thickness of rubber and lead. For a breakdown test the entire system was submitted to 3000 volts alternating current and withstood this test satisfactorily. The insulation guarantees varied from 400 to 1000 megohms per mile, and were realized under actual test.

A preliminary load curve of the plant was prepared by the engineers and submitted to the company previous to the commencement of the plant. This is given in Fig. 6, together with an actual load curve plotted with it. The points of difference are explained by an unexpected increase in arc business. The curve shows one great advantage of the storage battery. The entire plant is shut down from 1 o'clock until 5 in the morning, the load being carried by the battery. In the morning the machinery is started up and the battery charged during the forenoon; it remains connected with the system during the afternoon, and is discharged during the peak in the evening, as shown upon the shaded portion of the curve. It is again charged considerably during the first half of the night before shutting down. Interesting features of the load curve are the large all-night load and the comparatively low peak, or maximum load; the average output for 24 hours is 2198 amperes, which is about 40 per cent. of the maximum load.

The plant was built from designs submitted by Mr. B. J. Arnold, and built by Mr. Arnold's company. The entire station equipment was included in one contract under rigid guarantees from the contractor covering the efficiency of the plant as a whole. A definite cost of coal per kw-hour delivered to outside circuits from the switchboard was guaranteed under a forfeiture in case of failure, and with an equal bonus for increased efficiency above the figures specified.

The Kaiser and Wireless Telegraphy.

Emperor William's interest in technical investigations, especially those relating to the navy, kept him for nearly five hours at the High School of Technology in Berlin, recently, where the most interesting feature of the proceedings was a lecture, illustrated with experiments, by Prof. Slaby on Signor Marconi's system of wireless telegraphy as applied in naval improvements. The lecture was based upon a series of experiments on board the Friedrich Karl, near Kiel, when the operator succeeded in communicating over distances of from 45 to 48 kilometers. After the lecture the Emperor engaged the professor in a lively discussion.

Electrolysis of Cast Iron Water Mains.

By Prof. Lucien I. Blake.

The effects of electrolysis from electric railways are generally considered as limited to those points where currents are leaving underground metallic structures, for a passage through the soil and thence through other conductors to the power house. Voltage measurements have been relied upon to determine the regions within which currents are thus leaving the underground structures, and these measurements establish the so-called electrolytic danger areas. Recent observations and experiments of the writer prove, however, that effects of electrolysis upon water mains are not limited to the above determined danger areas.

If the water mains were continuous metallic conductors, then, indeed, no electrolytic dangers would occur to them outside the above areas, and they might be allowed to form a part of the return circuit of the electric railway. Then bonding these mains to return feeders would be safe and advisable, just as now the metallic sheathings of underground telegraph and telephone cables are so bonded. But, unfortunately, the mains are not continuous conductors. Resistance at the joints in cast-iron pipes is sufficient at most joints to shunt a portion of any current allowed in these mains, around the joint through the soil outside, or water inside, or through both. Thus on the positive side of joints the effects of electrolysis, both external and internal, are to be apprehended. To determine this as a fact beyond question, the writer has made, first, a series of measurements upon joint resistance in cast-iron mains, both in the laboratory and in the field, and, second, has discovered in many instances the actual electrolytic effects, both external and internal, near the joints.

Three lead-caulked joints, from a 6-inch cast-iron main, taken from the Kansas City water system, were measured by voltmeter-ampere-meter method, with the following results:

	E. M. F. (around joint).	Current.	Resistance.
Specimen I.	24 millivolts.	0.9 amp.	.0266 ohm
" II.	45 "	11.4 "	.0321 "
" III.	37 "	1.4 "	.0264 "
			Average, .0243 ohm

The resistance measured of a 12-foot length of this pipe gave .000354 ohms. The average resistance of these joints then is 79.9 times the resistance of one length of the pipe. The current was supplied from chloride accumulators, and Weston instruments standardized by Kelvin balances were used.

Measurements were then made upon a line of 6-inch cast-iron main which has been in use now thirteen years and is carrying water under about 80 pounds average pressure. This main is in the city of Lawrence, Kan., and 687 feet of it were measured. The following table gives the results:

No. of Tests.	Drop Around Joint, millivolt.	Ampere.	Resistance.
1	983.3	1.8	.546 ohm
2	1000	1.8	.555 "
3	1466.6	1.8	.543 "
4	1450	2.7	.537 "
5	1556	2.7	.580 "
6	1516.6	2.65	.574 "
7	983.3	1.8	.546 "
8	1000	1.8	.555 "
			Average, 556 ohm

Resistance of 58 lengths of 6-inch main at 0.000354 per length of 12 feet, .021 ohm; resistance of 58 joints, .535 ohms. The total resistance of the 58 joints forms, therefore, 96⅕ per cent. of the total resistance of the 687 feet.

Measurements of each individual joint resistance were then made upon 399 feet of 20-inch cast-iron main which had been in use in Kansas City since 1882 under 100 pounds pressure. This main crosses the Kaw river on a pipe bridge, and the housing was removed so that each joint could be measured. The readings were taken between midnight and 5 a. m., when but one "owl" car was running hourly upon the whole electric railway system, and an invariable voltage could then be supplied from storage cells.

The experiments were so arranged that voltage drop could be measured around each joint and simultaneously around one pipe length, including its particular joint. In this way resistances of joints in terms of pipe lengths were obtained. The following is the result:

Therefore the resistance of the joints is 88⅓ per cent. of the total resistance. The average of six direct measurements of the total drop of the above main gives .3 volt with a current of 9.2 amperes. This would give a measured resistance in 399 feet of the 20-inch main to be 0.326 ohm. The calculated resistance of this

No. of Joint.	Voltage drop around joint in millivolts.	Voltage drop along pipe. Not including joint.	Joint resistance in equivalent pipe length.
1	0.6	3.6	8
2	.8	3.4	4¼
3	1.0	8	8
4	.5	18.5	37
5	.4	19.6	49
6	.4	17.6	44
7	.6	17.4	29
8	.6	6.6	11
9	.6	9.8	16.3
10	.6	16.2	27
11	.6	10.2	17
12	.4	11.2	28
13	.4	6.4	16
14	.4	8.	20
15	.4	.2	½
16	.4	.6	½
17	.4	.2	½
18	.4	.2	½
19	.2	.2	1
20	.4	.2	½
21	13.	11.	9/10
22	.2	19.8	99
23	.2	17.8	88
24	.4	9.6	24
25	.4	3.6	9
26	.4	.4	1
27	.1	.2	½
28	.1	.2	½
29	.4	.4	1
30	.4	.4	1
31	.4	.2	½
32	.4	.2	½
33	.3	.1	½
34	.4	.2	½
35	.4	.2	½
36	.4	.2	½
37	.4	.2	½
38	.4	.2	½
	29.4	221.0	543 47/60

Total drop in pipe.....29.4

250.4

amount of 20-inch, exclusive of joints, is 0.0364 ohm. The joint resistance must make up the rest of the total measured resistance, or .2896 ohm. The joint resistances, therefore, form 88⅘ per cent. of the total resistance, which checks with the above within the limits of error.

It should be stated that for this calculated resistance of the pipe, measurements were made to determine the specific resistance of the cast-iron of the pipes. A Thomson's conductivity bridge was used, made by Hartmann & Braun, and the average of several measurements on two bars cut from the 20-inch main, which were respectively 500 mm. long and ¼x¾" in section. The copper bar for comparison was commercial bus bar ⅛x¾" section, 500 mm. long. The results gave an average of 56.5 times the resistance of copper of similar dimensions, and this number is used in the above calculations.

Measurements were also made on 400 feet of 36-inch main which was exposed in Kansas City. The total measured resistance, including the 34 joints, was .0103 ohm. The calculated resistance of the pipe alone is 0.000346 ohm. The joint resistance is therefore 96 7-10 per cent. of the total resistance. The current was from a storage battery, used after the railway power was cut off after midnight.

From the above direct measurements it is evident that the joints in cast-iron water mains form a large percentage of the total resistance of the mains and prevent the mains from being considered continuous conductors in the sense a metallic sheathing of a cable is. The resistance conditions for shunting a current around the joints are therefore present in general upon water mains.

Furthermore, that such shunting actually occurs on cast-iron mains in use and exposed to leakage currents from electric railways, has been proven by the writer by electrolytic effects discovered near joints, both inside and outside, on mains which the writer has taken up in Kansas City. A 12-inch pipe line running at right angles to an electric railway, and which was negative to the rails, was found to be carrying a current of varying strength and delivering it into a 36-inch main some 750 feet distant.

Electrolytic pittings were found on many sections near the joints, only on the positive side, where the current was shunted around the joints. Some of the pittings were ⅛ inch deep. The interior of the pipe could not be examined.

Again, a length of 6-inch cast-iron main was taken up in another part of the city and internal electrolytic effects were apparent near the joint. A chemical analysis of the material dug from pits gave 22.3 per cent. graphite, 49.7 per cent. iron. A second length was removed and broken into and a fresh fracture revealed *internal* electrolysis by the discoloration of the iron where the pitting was taking place, and which was already ¼ inch deep, beginning from the inside. A number of similar cases were discovered, and are convincing proofs that cast-iron mains cannot convey currents without electrolytic damage, when these mains form part of the return circuits of electric railways.

It is not the purpose of this paper to treat the general subject of electrolytic dangers to underground metallic structures, but to call attention to the fact that the use of grounded electric railway circuits is beginning to reveal these added dangers to cast-iron mains. The plan of occasional bonding of rails to water pipes when the pipes are negative to the rails, and then, near the power house, the further bonding of the pipes to return feeders, is sure to invite current upon the pipes, and thereby evidently intensify electrolytic effects at the joints. The insertion of insulating joints in the mains or an occasional non-conducting length, must act like joint resistance and thus still further endanger the mains. So long as leakage currents are allowed to traverse the mains it seems proven from the above that the mains are in danger, and corroborative evidences are accumulating in cities other than Kansas City, and which are known to the writer.

Nor does the asphaltum coating of the pipe protect it. Under the asphaltum, which remains bright and apparently intact, pittings will be found, and a fresh fracture or a careful scraping away of the coating will reveal spots of graphite structure, left from electrolytic action on cast-iron. It is obvious all conduction by the pipes must be avoided to insure immunity from electrolysis.

Double Voltage and Current Generators.

BY ALTON D. ADAMS.

An editorial in the ELECTRICAL WORLD AND ENGINEER of Nov. 11, 1899, points out certain objections to the simultaneous delivery of alternating current at high pressure and direct current at low pressure from the same generator. In the above issue a short article by the present writer suggested the use of double current and voltage generators "for the average station conditions," with a view to low first cost and high economy of operation. Thinking that some of the editorial objections, just referred to, do not apply to average station conditions, and that others are not so serious as they at first appear, the writer ventures the following, which may be regarded as an explanation of the position taken in the former paper.

At the start it may be pointed out that the suggestion as to the use of double current and voltage generators was not that they be adopted for power transmission purposes where pressures of 5000 or 10,000 volts or more are generally wanted, for the reason, among others, that in long distance power transmissions it is not common to have a large demand for low pressure direct current close to the generating station. The average central station conditions include a heavy and closely grouped load within a moderate radius from the station and another large but scattered load at much greater distances. Probably the most popular pressure for alternating current distribution to loads at distances common in town and city service is from 2000 to 2500 volts, the voltage at one of the stations in New York City, at Louisville, Atlanta, Hartford and other places too numerous to mention, corresponding to these figures. It is true that a few stations have put the pressure up to 3500 volts and a very few up to about 6500 volts, but these last are exceptions, whose example is not apt to be followed in the great majority of plants.

So far as the writer is aware, the tendency for some time back has been toward an increase in the number of armature slots for both high and low pressure alternators, the low pressure machines of course leading, and in double current generators and rotary converters the number of slots has reached the point where satisfactory commutation can be had at the direct current side. The new 200-kw double current units at the station of the Chicago Edison Company are reported to have 21 slots per pole, and there is no good reason why this number cannot be materially increased when it is desirable to do so.

It is not claimed that present practice in the construction of alternators provides as many armature slots per pole as are desirable for machines that are to furnish direct current. But it is held that properly designed armatures may have all the slots per pole necessary for satisfactory commutation and then be safely wound with both low pressure coils for direct service, and other coils to develop pressures at least as high as are common in average central station practice.

The question of safe insulation between the high and low pressure coils is largely attendant on the depth of slots. Considering for the moment only the ordinary form of armature core, it seems certain, from a practical point of view, that both the high and low pressure coils must go in the same slots. When it is remembered that condition as to alternator speed and the frequency of the alternating current make special proportions for the armature and frame necessary, when a sufficient number of slots per pole to insure good commutation is desired, it is evident that to double the number of slots desirable for direct current work is more of a problem than to provide suitable insulation between the high and low pressure coils.

The insulation between the high and low pressure coils in the same slots is a simple matter and much easier than the insulation of the high pressure coils from the core. With the ordinary type of armature core and two sets of coils in the same slots, the proper place for the low pressure coils is at the bottom, leaving the coils for high pressure to come next to the periphery. Both the high and low pressure coils should fill the entire width of slots, so that the insulation between each set of coils will simply take up a portion of the depth of slots, and may be very heavy and yet require but a small amount of room. The insulation on the high pressure coils must be heavy enough to guard against iron contacts and more slot room must, of course, be provided as the number of separate coils and therefore the total amount of insulation increases.

A requirement for more room in slots simply involves a greater section of iron in the armature core before the slots are cut. The increase in the initial section of iron necessary to allow for the difference between the room usually taken by the insulation and that necessary for it when the number of slots becomes great enough to insure satisfactory action at the commutator, can be provided for by a greater radial depth of the armature core, and at a very moderate addition to the cost of a machine. Inspection of the armature in an average alternator of large capacity will show plenty of room for an increase in the radial thickness of its core, without any change of the outside diameter. Should the necessary number and width of armature slots make a greater armature diameter desirable than is now common in a machine of similar capacity and speed, in order to maintain sufficient section in the teeth, the added expense will be small.

Double current and voltage machines are, however, by no means limited to the ordinary type of armature core, though it may prove the most desirable for the average case. An armature that readily suggests itself for the double wound machine has its core mounted in the spider in two sections, side by side, with a proper annular space between them, and magnet cores and poles excited by the same coils acting on each section. One section of this armature would obviously be slotted in any desired way for the high pressure alternating current coils and the other section in a proper manner for the direct current winding. The annular space between the two sections of the armature core would be wide enough to allow room for the end connections at one side of both the high pressure and the low pressure coils.

In this last named type of machine the insulation of the alternating current coils for high pressure current would be in no way influenced by the presence of the low pressure winding in the other section of the core, and coils can be wound for any voltage that may safely be developed in a moving armature. For the moderate pressures of 2000 or 3000 volts now used to distribute outlying loads from the average station there seems no good reason why both high and low pressure coils should not be placed in the same slots, the low pressure winding at the bottom. Direct insulation between the two sets of coils is then so readily accomplished that the only real problem is to insure sufficient insulation between each set of coils and the core. A permanent ground connection on the low pressure coils, either through a distribution system or directly at the machine, will limit the dangers from contact between the high and low pressure windings to destruction of the insulation at some point on the machine.

Another case of high and low pressure service direct from the windings of a single machine follows naturally from the consideration of double voltage. This case occurs where nearby loads can be operated by alternating current as well as the more distant service. The two sets of coils for the direct production of both high and low pressure alternating currents at the generator, may be wound in the same armature slots for polyphase service at each voltage or may be grouped separately in different slots and single-phase current delivered to each circuit. The difficulty as to the number of slots per pole, that must be overcome where direct current is wanted from the low pressure coils, is not met in this last case, since there is no commutation to be considered.

The first cost of a double current and voltage generator will no doubt be more than that of a machine to deliver energy at an equal rate and a single pressure, but it should be less than the combined cost of generators, transformers and rotary converters for the same service. What, however, is far more important arises from the fact that the double current and voltage generator will have a higher all-day efficiency than any combination of dynamos and transformers or dynamos, transformers and rotary converters that will give the same service. If the use of separate windings on the same armature core, as is now common in dynamotors, is too complicated, what is to be said of the crowded arrangement of two sets of magnet spools and cores, alternating and exciting armature coils, commutator and two sets of contact rings found in some alternators at this time?

Alternating Current Series Arc Lighting.

BY HENRY W. CLOTHIER.

Among other interesting articles published in your issue of Nov. 4, I have read a description of constant-current transformers, installed by the Hartford Electric Light Co., to replace series arc light dynamos, driven by alternating current motors for arc lighting, thus effecting a saving of 27 per cent. in power alone.

It may interest your readers to have some particulars of transformers almost identical in design, which have been in use in England for a considerable time. I therefore enclose a drawing (abstracted from Ferranti's British Patent No. 207, accepted in 1894), and a photograph taken in 1895 of an installation at Portsmouth, which show a type of transformer so like those you illustrate and explain in your journal that no other description is necessary.

The constant-current transformers at Portsmouth, England, are used in conjunction with rectifiers for lighting streets by arc lamps connected in series, and have been so successful that at the present time there are no less than thirteen towns in England alone where this system is working.

The details of the mechanical and electrical design have, of course, been improved, but in principle the up-to-date transformer and rectifier remain as they were first made over four years ago.

It is to be regretted that the Hartford Electric Light Co. were not successful in their attempts in importing a rectifier for trial from Europe, for a still greater saving in power might have been effected. S. Z. de Ferranti, Ltd., of Hollinwood, England, claims that a rectified current, 10-amperes arc, will give the same useful light as a 15-ampere alternating current arc lamp. Thus with due allowance for losses on the rectifier and commutator, the power required at Hartford could have been reduced by at least 50 per cent. instead of 27 per cent.

Use of Electric Boring by Safe Breakers.

Members of the American Bankers' Association, which includes the largest financial institutions in the country, have long been apprehensive of burglaries through the use of electricity. It has been feared that the massive vaults, considered impregnable to the bank burglar's art, would yield to a powerful electrical current in the hands of expert cracksmen. The Pinkerton Detective Agency, of this city, was requested to make a rigid investigation. In a report just made, the agency says: "It is held that bank vaults and safes of the best make can be opened by means of electricity. It is claimed that this can be done by the use of storage batteries or by making a connection with trolley or electric light wires. We have investigated a large number of these so-called tests, and in every case have ascertained that power greater than could be obtained from ordinary storage batteries was required, that parties making

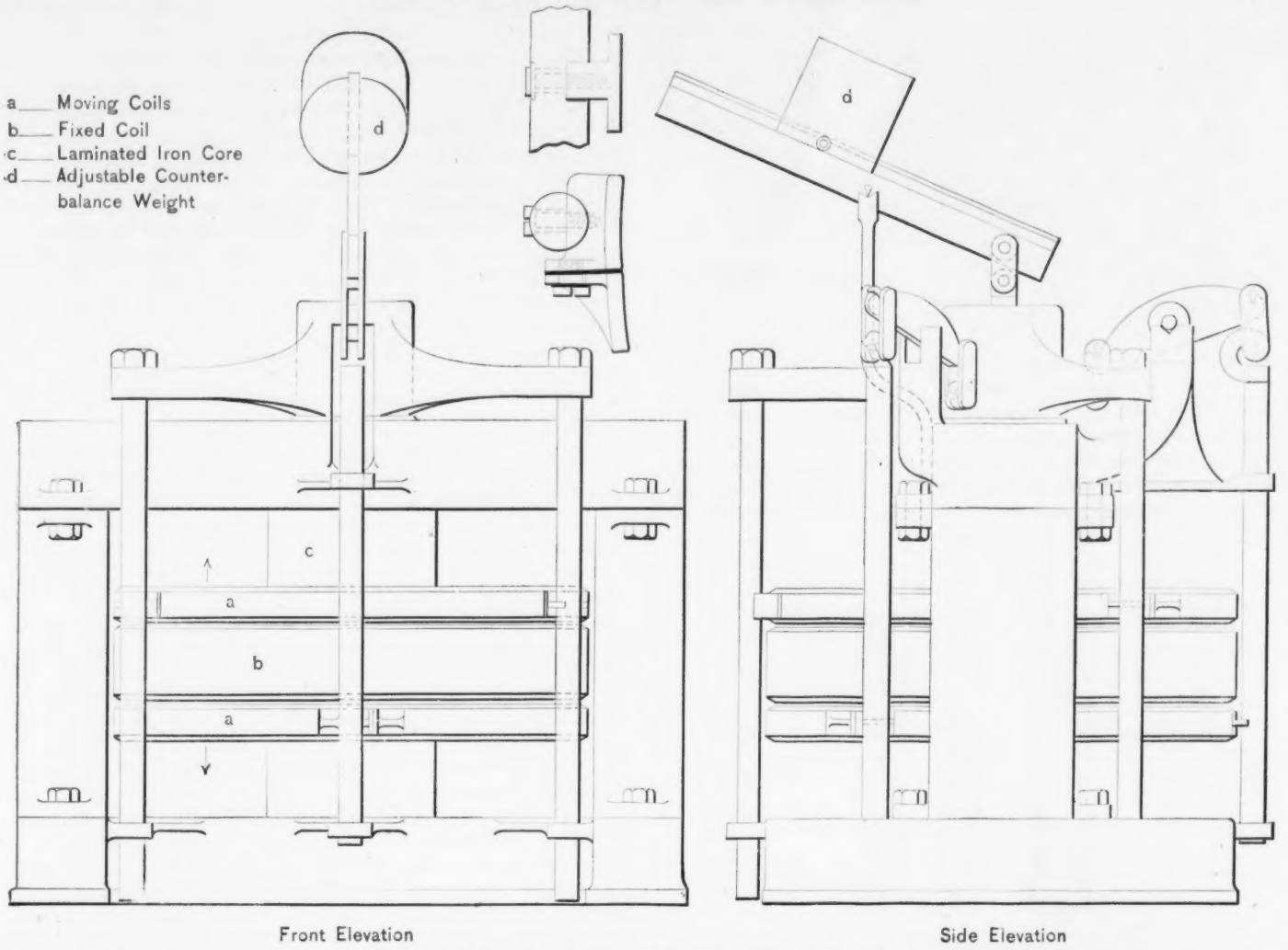


FIG. 1.—FERRANTI CONSTANT-CURRENT TRANSFORMER.

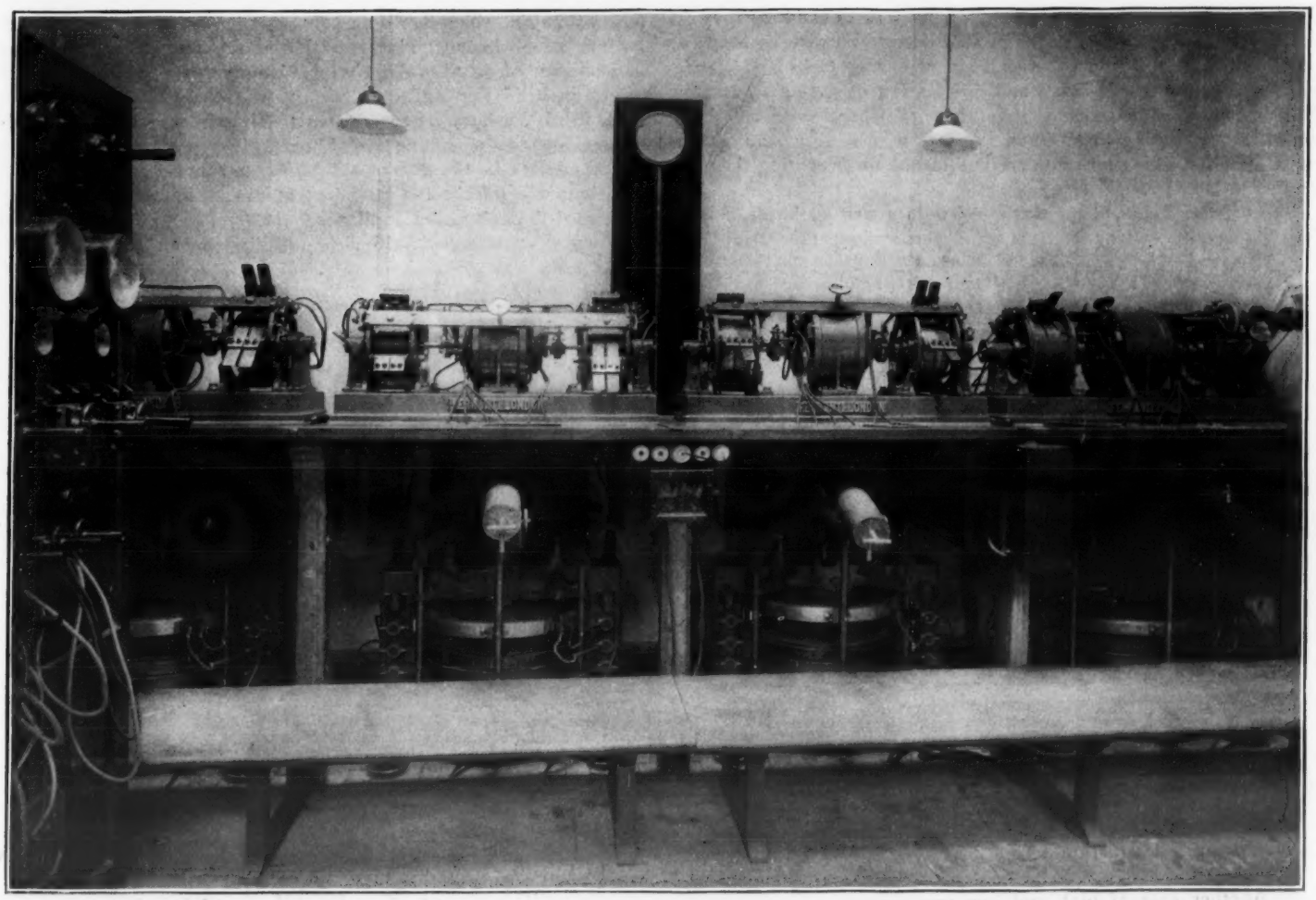


FIG. 2.—45-LIGHT, 12-AMPERE FERRANTI TRANSFORMERS AND RECTIFIERS AT PORTSMOUTH, ENGLAND.

these tests, when made away from their home plants, were obliged to first make arrangements with engineers in buildings having dynamos in use to supply extra power, or, where power was taken from trolley or electric light wires, arrangements had first to be made with the superintendent or engineer of the plant to add to the ordinary power at the time of test in order that it would be successful. To conduct a successful test of melting steel with storage batteries would require such preparation and equipment as to make it practically impossible to use the power to commit a bank burglary without discovery."

In other words, the thing is a great improbability, and practical impossibility, with or without the batteries.

Some Recent Telephone Patents.

The budget of United States patents for Dec. 5 include ten in the department of telephony. Five of these were issud to Mr. Charles E. Scribner, three being on telephone switchboard signals. One of the latter is on incandescent lamps and sockets designed for use as secondary signals in telephone switchboards. For use as a

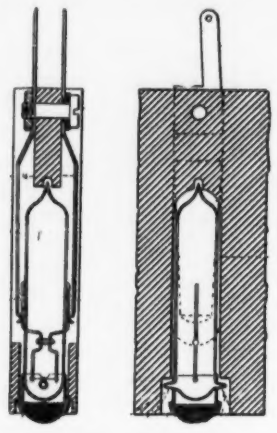


FIG. 1.

secondary signal associated with the spring jack of the line, it is essential that an incandescent lamp shall occupy a space as small as possible in order that a great number of spring jacks and signals may be brought within reach and observation of a single operator. The invention named relates to a form of signal lamp and lamp socket accomplishing that object, together with a device for retaining a light-dispersing lens in place and means for mounting the lamp in the socket.

Referring to Fig. 1, the socket consists in a strip or block of insulating material, having a transverse perforation, the strip being preferably of the same size as a strip of spring jacks. A pair of contact springs is mounted at the rear of the strip, and have free ends projecting into the perforation near its forward extremity. The lamp has a cylindrical bulb adapted to fit loosely into the opening in the strip. The platinum wires forming the terminals of the filament are led to plates secured on opposite sides of the bulb near its forward end and in position to register with the contact springs of the socket; projections are formed upon the bulb designed to enter recesses in the socket to retain the lamp in such position that the contact between the terminals of the lamp and the contact springs is maintained. The dispersing lens (shown in black) is mounted in the extremity of a short tube adapted to enter the orifice of the chamber containing the lamp, the tube being provided with suitable means for retaining the lens in place.

A second Scribner patent relates to supervisory signals for association with united telephone lines to indicate to the attendant the condition of the telephonic appliances at the substations of the lines; the object of the invention being to provide a means of controlling the supervisory signal in such a way that it may act in response only to those acts of the subscribers which are of interest to the operator in the performance of her duties. The invention permits the display of a supervisory signal associated with the call line until the called party responds; thereafter permitting its display again only to indicate a call for disconnection upon the replacement of both telephones on their switches at the substations.

It consists in the combination with united lines, of a supervisory signal designed to come into a bridge of the line; a source of current; an electromagnet having a winding in each line, and switch contacts controlled by the magnet and adapted to connect the supervisory signal with the line of the called party when idle, and to connect it with both lines when in use. The supervisory signal indicates the current in the line of the called party when the telephone at the call station is removed from its switch for use, but thereafter is controlled by current in both lines, and serves to indicate only the cessation of current in both.

The indicators of all signals associated with plugs not in use are hidden. The display of an indicator immediately after the establishment of connection with a line indicates that no response has been made to the call sent. The signal is hidden when the called party takes the telephone for use, and the signal is thereafter displayed only when at the termination of the use of the line both telephones are returned to their supports. This avoids all confusion of signals and eliminates all indications on the part of the signals, excepting those which are found in practice to be essential to the proper establishment and supervision of the connection. Owing to the amount of detail, a description of the various devices cannot be given in brief abstract.

A third Scribner patent relates to signals associated with telephone lines in telephone switchboards, designed to be controlled automatically in the use of substation telephones, and serving to continuously inform the attendant at the switchboard of the condition of the substation appliances. It consists of a system of secondary electromagnetic signals controlled by electromagnetic device associated with the line, and responding to changes in the electrical condition of the line as determined in the use of the substation telephone; this device serving to control both the line

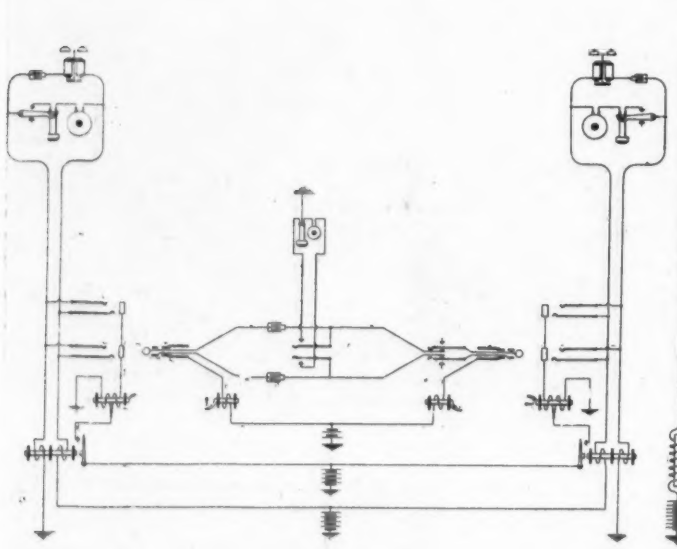


FIG. 2.

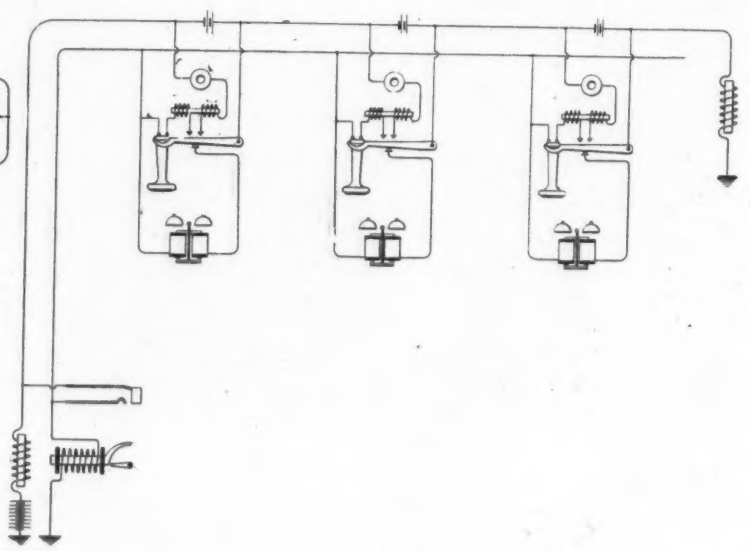


FIG. 3.

signal and the supervisory signal at different times. The purpose of the invention is to avoid as far as possible closed bridges of the line circuit by magnets interposed in the telephonic circuit.

The signals comprise a line signal permanently associated with the line and representing it in the switchboard, and a supervisory signal adapted to have temporary association with the line during connection with it. The invention also involves a mode of effecting the concealment of the line signal when connection is made with the line in response to a call; a new arrangement of circuit connections whereby the display of the line signal of a call line during the use of the latter is prevented; and means whereby the

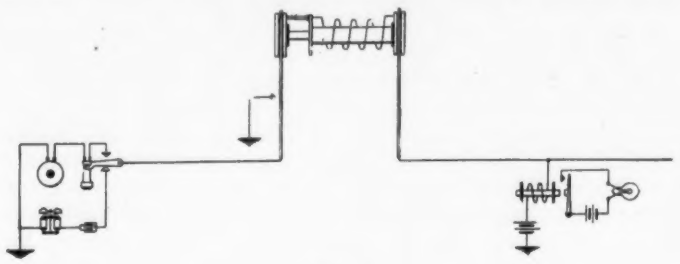


FIG. 4.

supervisory signals associated with the usual connecting plugs in the switchboard are brought temporarily under the control of the electromagnetic signal controlling appliances of the united lines. Referring to Fig. 3, a relay constitutes the signal controlling appliance, and is connected in a permanently closed bridge of the line circuit, which includes also a source of current together with a switch at the substation automatically operated in the use of the telephone to change the circuits at the substation and thereby affect the relay; a local battery in a switchboard for the relay; and an electromagnetic visible line signal having a winding in the local circuit and adapted to display its indicator when excited; a differential or equal winding on the magnet of the line signal; a circuit including this winding and means for closing the magnet in the act of making the connection with the line to render the line signal inert; an extension of the local circuit controlled by the relay, temporarily completed in registering contact pieces of the terminal spring jack of the line and of the plug therein during connection with the line; and a supervisory signal in this temporarily extended circuit adapted to display the indicator when deprived of current.

In Fig. 2 are represented two substations connected by telephone lines with spring jacks and signal controlling relays in a telephone switchboard, together with a pair of plugs for uniting the lines and signals associated with the plugs according to the method of the invention.

A fourth Scribner patent relates to party telephone lines in which the transmitting telephone at each substation of the line is excited during its use by current from a storage cell at the same station, which is charged during the idleness of the line. The object of the invention is to provide a satisfactory mode of simultaneously charging the storage batteries at the different substations. Referring to Fig. 3, the invention consists in including the different storage batteries in series in the telephone line circuit and in providing at the distant end of the series a normal return connection of such character, that while permitting the flow through it of current for charging the storage batteries, it shall not permit the shunting of telephonic currents from the line circuit. The local storage batteries at the different substations are in series in the line circuit, and the line conductor is grounded through an inductive resistance or impedance coil after passing through the battery most distant from the central station. All the local storage batteries thus receive the same charging current. At the same time loss in efficiency of telephonic transmission through the shunting of telephonic currents to ground is prevented, the impedance coil at the distant station obstructing the passage of such currents to ground at that point.

When a telephone at a substation is removed from its switchhook for use, the circuit is closed through the comparatively low resistance bridge of the line circuit which includes the receiving telephone, so that sufficient current from the main battery, shown at the left of the illustration, reaches the line conductor to excite a suitable signal instrument in that circuit. During the use of the line for conversation, the telephonic currents in the line will traverse the line conductor, including the local storage batteries, without opposition from these batteries. No appreciable portion of the telephonic current will escape, either through the impedance coil at the terminus of the line or through the coil in the central station, shown at the left, on account of the opposition presented by the self-induction of these two coils.

The fifth Scribner patent is on a thermal protective device for use with telephone lines to protect the instruments from abnormally strong currents accidentally present in the line. Fig. 4 is a diagrammatic representation of the essential parts of the device, showing their arrangement in the line circuit. The elements of the device are a thin spool, preferably of copper, carrying a winding which constitutes the heating coil. A pin, shown to the left of the spool, projects deeply into the axial opening of the spool, and is secured therein by solder or other easily fusible cement. One terminal is attached to the body of the spool and the other to the projecting pin and also, by a small contact piece, to the face of the spool by means of fusible conducting solder or cement.

The electrical circuit through the device includes the heating coil, a portion of the body of the spool and the small contact piece above referred to. The two terminals extending in the illustration downward from the spool, consist of springs, the mechanical strain of which tends to withdraw the pin from the spool and to separate the contact piece, this strain being borne by the comparatively large section of fusible cement uniting the pin and the spool. The left hand spring when released makes a contact which earths the line. By this device there is involved a small range of movement of the separable parts, and an incidental advantage is the ability to employ a non-conducting fusible cement to unite those parts which bear the tensile strain.

A patent issued to Seymour Morrison and Thomas L. Springer relates to a telephone switchboard having a combined operator's cam and self-restoring clearing-out drop, the combined cam and drop being compact in form, self-contained, easily and quickly detached from its connections with the board and readily replaced in position; also, simple and strong in its construction, with no delicate adjustments to become easily disordered, speedy and accurate

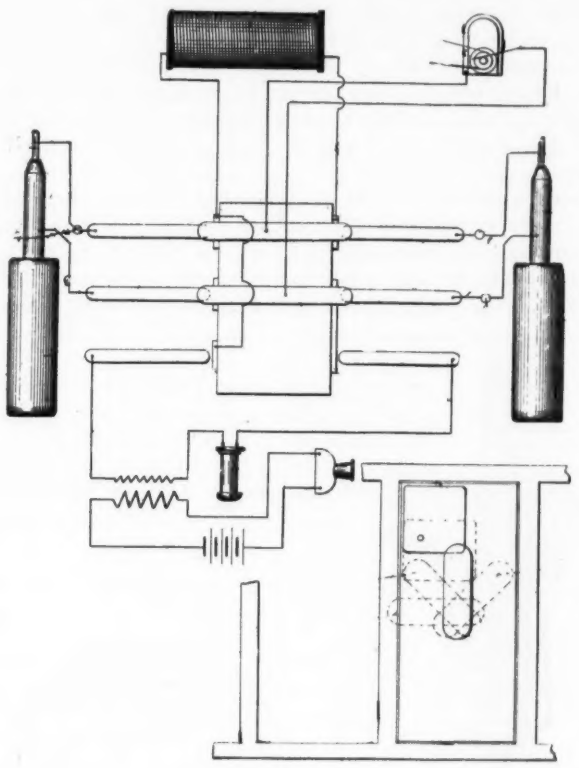


FIG. 5.

in its operation, and eliminating cross-talk between adjacent lines and preventing the calling subscriber from hearing the noise of ringing up the called subscriber.

The upper part of Fig. 5 illustrates the several electrical connections made in the operation of the cam and drop; the lower part is a face view of the operator's cam and drop, showing its relative position in the switchboard and also showing in dotted lines the several positions assumed by the cam handle in the operation of the cam. The four positions of the cam handle shown imply four sets of connections made by the switches within the cam. The

vertical position represents the operator's circuit as "bridged in" on the lines extending to the answering plug, and therefore presumes the operator to be in connection with the calling subscriber. The horizontal position represents the cam as turned to throw the generator lines into connection with the lines of the calling plug, whereby the called subscriber is notified by the ringing of his bell. This connection also cuts out the answering plug lines and the operator's circuit. The position midway between the above assumes the switches in such relative positions that the plug lines are made continuous through the operator's cam, the operator's circuit

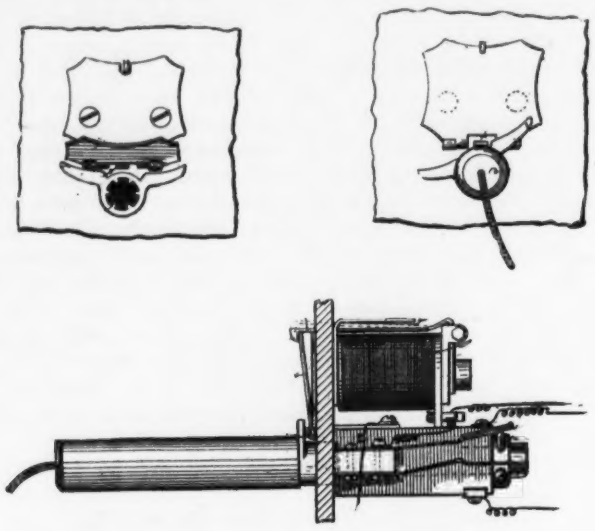


FIG. 6.

being cut out, but the magnet for the clearing-out drop included on one of the plug lines. The position to the right indicates the cam in a position to connect the calling subscriber's lines with those of the generator, whereby the call bell of the calling subscriber may be rung, the lines of the called subscriber and the operator's circuit being cut out. The clearing-out drop will be actuated by the operation of the hand generator on the telephone of either subscriber, but only when the plug lines are continuous through the cam, as assumed in the horizontal position of the cam handle.

A patent issued to Samuel B. Rawson relates to plug switches for connecting one circuit with another, and is more especially designed for use in connection with telephone lines and switchboards, whereby connections, either local or line, can be made and broken at any time. The contact points are formed of electric conducting

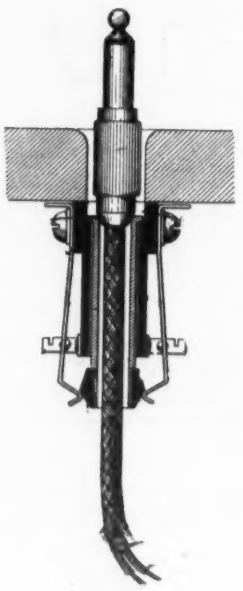


FIG. 7.

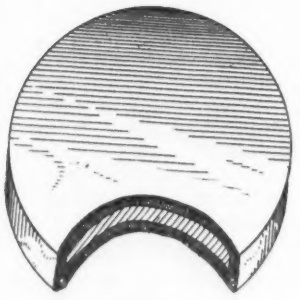


FIG. 8.

material and in turn connect to the different lines forming or constituting the main or local circuits and embodying either the local generator or local telephone of the exchange, or the telephones and signals of the subscribers, and also the local signal of the exchange.

The object of the invention is to so construct the plug switch that the insertion of the plug and the manipulation of the same by the operator at the exchange will act for the purpose of switching in the local telephone and at the same time cause the signal to resume its normal condition or position; and also by further manipulating the plug, to call the subscriber and switch in connection between the subscribers desiring connection one with the other.

The lower part of Fig. 6 is a view in side elevation of a section of switchboard showing the plug turned to the position for turning on the generator to send a signal to the subscriber. The two lower illustrations show the plug switch with the shutter in drop position and with the shutter in normal position, the right-hand figure showing the plug inserted and manipulated so as to turn in the local or exchange generator to signal or call the subscriber.

In a patent granted to James M. McQuarrie, a plug seat switch is described for use with connecting plugs and telephone switchboards for the purpose of changing circuits automatically upon the removal of the plug and its replacement. The object of the invention is to produce a plug seat switch which shall be operated by the weight of the plug and its attached cord and shall be of simple and durable construction. The switch, which is shown in Fig. 7, comprises a vertically movable tube or sleeve, through which the cord passes; this sleeve extends into a resting socket of the plug and has an enlarged head adapted to receive the plug. The free portion of the tube carries a tapered or conical collar, and switch springs bear with their free ends upon the oblique surface of the collar. The lower extremities of the springs are curved inwardly and brought to bear upon the inclined face of the collar, so that when the latter is forced downward the springs are spread apart. The springs exert sufficient pressure upon the collar to raise the tube to the upper limit of its range of movement when free, but yield under the weight of the plug and cord when the latter rest upon the tube.

A patent issued to Hosea E. Husted and William S. Jones, describes a composite diaphragm for use in telephones, phonographs, etc. As shown in Fig. 8, it consists of a metallic sheet or disk of requisite thickness covered upon one or both sides or faces with a coating of metal which solidifies on the surface, so that when finished the diaphragm, as constructed, is the equivalent of a single piece. The object of the invention is to overcome the objection against composite diaphragms when they are made of two or more sheets or disks not connected in such a manner as to form a solid disk, which results in giving to the sound a sharp, harsh and metallic note.

A patent issued to Alexander E. Keith, John Erickson and Charles J. Erickson, is on some new devices for, and modifications of, the Strowger type of automatic telephone exchange. The patent includes eighteen figures and, the references being in minute detail, the patent does not admit of brief abstract.

The Extent of the Erie Bell Telephone System.

The fact that the American Bell Telephone Company is not a majority, but a minority, stockholder in the Erie system gives special interest to the data of its growth and extent at this juncture.

The Erie owns a large controlling interest in companies operating one-sixth of the entire telephone business of the United States as follows: The Cleveland Telephone Company, Northwestern Telephone Exchange Company, Southwestern Telegraph & Telephone Company, Michigan Telephone Company and Wisconsin Telephone Company. The aggregate number of subscribers in these companies now exceeds 102,000, and is increasing at the rate of 50,000 per annum. This property is located in seven states and one county in Ohio. The total amount of capital employed is $21,000,000, all of which is represented by the capital stock except a bond issue of $2,500,000 made by the Michigan Company, for development of which over $1,000,000 remains in the company's treasury not yet expended. All the subcompanies of the Erie system are absolutely free from bonded or floating indebtedness, except the Michigan as above noted.

The Erie managers have received a sufficient number of proxies to insure the passage of the resolution increasing the capital stock from $5,000,000 to $15,000,000, which will be done at the special meeting to be held in New York, Dec. 15. The new stock will probably be offered to stockholders in three or four instalments during

the near 1900, to the extent of $5,000,000, all of which has been underwritten at par. The proceeds of this large new issue, put into the property during the year 1900 will increase the capital employed at the close of the year to $26,000,000. This is pretty close up to the present capitalization of the Bell Company, although at the market price of the Bell stock the capital would equal three and one-half times that of the Erie.

The Erie system will use $5,000,000 this year in adding 43,000 subscribers, making a large extension of its long-distance service and acquiring twenty pieces of real estate and erecting buildings thereon. This investment has increased the gross earnings close to $1,000,000, or total earnings in the neighborhood of $4,000,000, of which the Erie will receive a sum equal to about 8 per cent. upon its outstanding capital after deducting all interest and other expenses. The company's dividend is now at the rate of 5 per cent., and 3 per cent. will be carried to reserve. The Erie system made a net gain of 3787 subscribers in November. The total connected Nov. 30 was 102,460, making a net gain since Jan. 1 of 39,717.

An Innovation in Connecticut Telephone Service.

The Southern New England Telephone Company, practically controlling nearly all the Bell telephone business in Connecticut, announces that for the city of New London and borough of Winsted it will install instruments for inward "call" service at $9 a year or 75 cents a month for New London, and $6 a year or 50 cents a month at Winsted. The installation of instruments will be at the expense of the company, and the new service will begin on January 1, 1900. Outward service from the same instruments will be at the rate of five cents a message. President Tyler, of the Southern New England Company, says that the experiment—which is made for a year—has never been tried before in this country outside of the Pacific region.

Mr. Victor Morris Tyler, of the Southern New England Company, writes us on behalf of the president: "These new rates, in both cases, are purely experimental. Contracts for this kind of service will only be received by us during this month, and only for the year 1900. Whether we shall continue this arrangement or not depends entirely upon the number of applications received, and whether we shall introduce it into any of our other exchanges depends upon the success of these two ventures. Party service, of course, is the only kind of service that we intend to furnish at this rate, this scheme having been devised for the purpose of reaching as many customers as possible who do not feel that they can afford a telephone at any of our other rates." The plan has been well advertised in the specific locality, and its results will be watched with much interest.

The Government Printing Office.

The proportions of the new government printing office, at Washington, are of more than usual interest. It will cost more than $2,000,000, and yet the fear is already expressed that it will not be large enough to meet the demands upon it, and that an addition will have to be undertaken about as soon as the keys of the building are turned over to its occupant. This fear might, however, prove groundless if Congress would only give the Public Printer the modern appliances, including type-setting machines, of which other printing offices now make use. These would be equivalent to the addition of a large amount of floor space. They may be introduced, if desired, in a roundabout way through the census printing office, which will be stocked with all the most modern machinery. When the census is complete and its reports published, perhaps Congress will turn this machinery over to the government printing office. The new building will be eight stories in height, including basement, and the floor space will amount to about nine acres. Steel columns to the number of 370 will enable the floors to sustain a load of 85,000,000 pounds. There will be twelve electric elevators, 7,000 incandescent lights, and a complete system of "interior" telephones. Among the novel features will be an ice-plant to furnish cold filtered water for drinking purposes in every part of the building, and a crematory to destroy refuse, the combustion of which will heat the water needed for binding and other mechanical operations.

CURRENT NEWS AND NOTES.

ELECTRIC RAILWAY IN THE KLONDIKE.—A syndicate is at present building an electric street railroad in Dawson City, and a line is to be built across the river to Klondike City if the necessary aid is obtained from the Canadian Parliament. The line is to be extended up the Bonanza River to Fort Bonanza and Eldorado.

THE PARIS UNDERGROUND RAILWAY.—It is announced that the Metropolitan Underground Railway will open on June 1, 1900. All the stations have been completed and the stone archway of the subterranean road has been built for 6200 meters (3.85 miles) of the total length of the roadway, which is 11,500 meters (7.14 miles), and all is ready to begin the work of ballasting and rail laying.

STEERING VESSELS BY ETHER WAVES.—An invention has been tested at Weymouth, England, for steering any craft, whether submerged or otherwise, by means of ether waves. It is stated that the model was subjected to a variety of tests, and that it followed the ether waves as surely as if guided by a rudder. In addition to steering in straight lines various figures were described.

ELECTRIC RAILWAY IN CALAIS.—Consul Milner, of Calais, France, informs the State Department that a company organized at Paris is arranging to establish an electric railway in Calais. The equipment has not yet been purchased, and the Consul thinks that United States manufacturers may wish to bid. The old tram cars now in use are of American make.

IS JERNEGAN IN LONDON?—It is reported from London that a provisional patent has been granted by the British Government for the extraction of gold from sea water. The patentees say they have discovered a combination of chemicals which will precipitate not only the organic matter in sea water but also the gold, without the use of electricity. A mint analysis certifies that a sample of sludge, representing fifty gallons of water, contained 0.150 grains of gold.

ELECTRIC RAILWAYS IN HONOLULU.—It is reported that ex-Congressman Tom L. Johnson and his brother, Albert Johnson, with the aid of New York capitalists, will build a street railroad in Honolulu and on Oahu Island, on which the capital of the Hawaiian Islands is situated. Not only will electric lines be built within the city limits, but suburban lines will be constructed leading to the different points of interest and business near the city. A route will be built to the volcano, for the convenience of tourists, and it is thought that this line will prove especially profitable. The steps toward securing the franchise from the government for the construction of the proposed lines were taken by Tom L. Johnson. In addition to the street car lines, the company has secured the privilege of operating a line of ferryboats to and from the island. The syndicate expects to have a monopoly of the traffic of the island. Frank Haines, of Elyria, will be the chief engineer in the construction of all the lines. He is now engaged in organizing a company of workmen in Cleveland, and will leave for Honolulu early in January. It is expected that work will begin about Feb. 1.

RAIL BONDING.—In a paper on "Rail Bonding," read at a recent meeting of the Franklin Institute, Mr. M. A. Harrington cited tests of cast-weld joints showing that the resistance of a cast-weld joint upon a 9-inch girder rail was 30 per cent. greater than that of a corresponding length of solid rail section. The results of different tests using various forms of bonds around the under cast-weld joint were cited, showing that the results were not very satisfactory. The tests made upon a special design of bond consisting of a piece of sheet copper 30 inches long by 4 inches wide by 3-16-inch thick, making contact against the web of the rail and held in place by 1-inch bolt, gave a resistance of the cast-weld joint thus supplemented, 20 per cent. less than the resistance of the corresponding length of solid rail section. Mr. Harrington showed an assortment of bonds embodying the principle of contacting with the web of a rail to be placed under fish plates, and to be held in place by heavy set screws going through the fish plate. A sample of one of these bonds was exhibited which had been in use for over two years, its contact face being perfectly bright and clean.

OPENING OF A NEW SUBMARINE CABLE.—A submarine cable between St. Helena and Cape Town, Africa, was opened a few days ago for public telegraph business.

THE LA BELLA MILL, WATER & POWER COMPANY, of the Cripple Creek, Col., mining district, has issued a luxurious souvenir commemorating the starting of its power plant, in which the various details of the plant are illustrated by beautifully executed half-tones, almost twoscore in number. In typography, paper and cover the publication represents the highest art of the bookmaker. The same company has also issued a leather-bound "Power Booklet," compiled by Mr. L. L. Summers, consulting engineer to the plant. The contents consists of rules and their application to hoisting, pumping, air compressing and electrical distribution, and also includes tables of power charges and cost of electrical supplies.

AN OCEAN OF CURRENTS.—The following delightful item is from a batch of Paris correspondence in a leading New York daily newspaper. The writer is evidently a more hopeless case than Miss Fuller herself. "I met Loie Fuller last Sunday at the house of that charming American lady, the Marquise d'Oyley. With the glasses she is now obilged to wear, Loie is not easily recognizable off the stage. She suffers from her nerves, the result of dancing as she does in an ocean of conflicting electric currents. The electricity was bringing her hair off, loosening her teeth and turning her deaf and blind. She is getting better now owing to careful treatment, and her conversation is still sprightly and witty. On the first of next month she is to appear at the Olympia in a new dance." This is the worst slander on the poor projector we have ever seen.

MULTIPLE BLADE STARTING SWITCH.—A patent was granted Dec. 5 to Gano S. Dunn on a rheostat provided with a set of independently operated switches with means for preventing the closure of contact at the switches except in a definite order. Each of the set of switches is independently operated by hand and an interlocking device prevents the closure of a switch other than in the proper order to effect a graded increase in the motor current. The interlocking device consists of a bar under the blades of the switch, having a movement transverse to the blades. In the bar is a series of notches, and except when the corresponding notch is under the switch blade, its closure is prevented. The closure of each switch, with the exception of the switch to be last closed, causes the bar to advance an additional step, and places it in a position to permit the closure of the succeeding switch. A latch on the bar prevents closure of contact at an electromagnetic circuit breaker except when all the rheostat contacts are open.

THE GOUBET SUBMARINE BOAT.—A despatch from Paris gives some details of the recent experiments at Toulon with the submarine boat Goubet. The tests are said to have been successful. The boat carried a crew of three men. It plunged down five meters (16.4 feet) below the surface and remained submerged for five hours. Upon arriving at the surface the crew was well and had suffered no inconvenience. At another trial the Goubet, preceded by a launch to give warning, crossed the roadstead with its dome twenty-five centimeters (9.8 inches) below water. It also made two instantaneous descents, traveling under water fifty-six meters (61.2 yards) during each one. In spite of a heavy swell the submarine boat gave evidence of remarkable stability. Finally, near Fort Eguillette, the Goubet again disappeared under the surface and remained hidden for twenty minutes. It was impossible for those following the experiments in the accompanying launch to discover the Goubet's whereabouts until she appeared again on the surface.

THE PACIFIC CABLE IN CONGRESS.—The second bill introduced in the present session of the United States Senate was one offered by Senator Hale, of Maine, on Dec. 6, to authorize the construction of a cable from the United States to Hawaii and Manila by way of Guam. It authorizes the Secretary of the Navy to contract for the laying of the cable, which is to be operated under the direction of the Postmaster General, and $11,000,000 is appropriated for the purpose. The bill was referred to the appropriate committee. On Dec. 5 a bill was introduced in the House of Representatives for the laying of a cable to the points named above. The cost is limited to $8,000,000 and a preliminary appropriation of $500.000 is made to begin the work. The cable is to be laid under the direction of a commission composed of the Postmaster General, the Chief Signal officer of the Army and three other members to be appointed by the President. The rates are to be not more than 35 cents a word from San Francisco to Honolulu and not more than $1 a word to Manila. This bill is now in committee.

ELECTRICAL EYES.—Our English contemporary, *The Electrician,* has investigated the operations of a Mr. Steins, described as a Russian scientist and a doctor of philosophy, who claims that he has succeeded in producing electrical apparatus which forms a sufficient substitute for the eye itself. A representative of the London *Daily News* who interviewed him, asked, "You say you will make the blind to see," and received the reply, "Absolutely. I give artificial sight and it makes no difference whether the person was born without eyes, whether the eyes have been wholly or partially destroyed since birth, or how the sight has gone. My apparatus will, as in the camera, focus the rays of light from the object to the brain and sight is given, the objects being clearly seen, not inverted, but in their proper form. As long as the receiving part—the brain—is there, my apparatus will do the rest." The statement was also made to a representative of *The Electrician* that he had within a week no less than seventy blind people at his laboratory, and that in each case the person was able to see him before he left. The result of our contemporary's investigation was that the claims of the man are entirely groundless. It prints an article by Mr. G. H. Robertson, F. C. S., who has been blind for six years, and who also investigated the case. Mr. Robertson saw the man Steins in his laboratory, but he could obtain no experimental proof in substantiation of the claims published. On the other hand, he learned that the name of an authority connected with the Royal Normal College for the Blind had been falsely used by Steins.

POWER FROM THE PACIFIC OCEAN.—The Dominion government is now considering the application of the British Columbia syndicate for foreshore privileges in Vancouver harbor, to which project reference was made in these columns last week. If the scheme to establish the proposed electric power works to be driven by the water that rushes into the harbor of Vancouver, through the Narrows, at nearly all stages of the tide, proves as successful as it is unique, the enterprise will be of great value to the syndicate in a very short time. Prospect Point, which is one of the best known of the scenic attractions of Vancouver at the entrance of the harbor, will be the site of the principal works for the generation of electricity to supply the lower mainland. About 2000 feet of the foreshore extending out 150 feet from the narrowest part of the harbor, is asked for there, and further down at Brockton Point about the same amount of property is included in the request. Further up, on the opposite side of the City of Vancouver, there are extensive tide flats, opposite which are the dangerous narrows, and this location the syndicate asks to be granted to them for a distance of one mile long and half a mile in width, with about half as much land, also, on the opposite side of the Narrows. This is the spot where it is proposed to erect the main electrical buildings. The three points are far enough apart that the tide changes come at different times, and there is always a run of five or six miles an hour at one of them. If all else should fail, there is a large stream running through the tide lands from the mountains, and this, in itself, would be sufficient to supply all demands. If the government grants the concessions, a strong local company will be formed to exploit the scheme.

AUTOMOBILE MOTOR CONTROL.—A patent issued Dec. 5 to Frank B. Rae, Chicago, relates to the winding of an electric automobile motor and details of its circuits and controlling mechanism. As described, the storage battery is divided into two groups; the field magnet coils are in a number of sections, and a commutating switch or controller enables the storage batteries to be placed in circuit with the field magnet coils either in series or multiple arc. Between the segments of the commutating switch or controller are resistances which enable commutation of the field coils in series, in series multiple and in multiple to be effected without short-circuiting or interrupting the continuity of the circuit. In starting the motor, all the field coils are connected by means of the controller in series and supplied by current from the batteries connected in multiple of two groups. Under this condition of the several parts, the e. m. f. tending to pass a current through the several field windings will be equal to that of one set of cells only, and the resistances of the field coils in series will be such that the amount of current flowing at this

time will not be excessive, not exceeding, in fact, the normal current output of the batteries. At the same time the number of effective turns of the coils upon the field magnet is sufficient with this current to produce a strong field magnetization. While the armature of the motor will therefore revolve at comparatively low rate on account of being supplied with but half the e. m. f. of the entire battery, it will exert a very great torque or starting effect. To produce greater speed, the batteries are thrown in series with each other, the connections of the field coils remaining the same—a double speed being thus obtained. For further increase of speed the field coils are arranged in two multiple groups. By this arrangement the effective turns upon the field magnet are reduced one-half, thus lessening the field strength and increasing the speed of the armature. A further increase of the speed is obtained by moving the controller so as to reduce the number of turns in the field magnet to one-quarter what they were when all were connected in series. A still further increase of speed is obtained by shunting part of the current from the last-mentioned arrangement of field coils.

THE MOTORMAN.—At the meeting of the Engineers' Club, of Philadelphia, on Saturday, Dec. 2, Mr. Charles Hewitt, engineer of the Union Traction Company, of that city, contributed some interesting results of observations in a brief paper, under the title of "The Motorman as an Element of Street Railway Economy." Tests were made by him by placing a wattmeter on a car without the knowledge of the motorman, and then having that car run on various routes by a number of different motormen. All the necessary records, such as the number of passengers, the time, etc., were kept and the results were given in two tables, one showing the watt-hours per car mile by trips irrespective of motorman, and the other showing the watt-hours per car mile per motorman irrespective of trips. The results showed that the number of passengers carried had an almost inappreciable effect on the watt-hours per car mile, and that the variations in the amount of energy consumed depended almost entirely on the motorman. The watt-hours per car mile varied very greatly for different motormen, but were nearly constant for the same motorman. They indicated that the usual test of a motor made in this way is really a test of the motorman. Omitting extremes, which may have been due to abnormal causes, the saving if all motormen were as good as the best, amounted to 43 per cent. The results showed what an important factor the motorman really is in the amount of power consumed by the cars, and how important it is to properly instruct the motorman in the most economical use of the controller. He also mentioned some tests in which the motormen were instructed to use only the series connections, and it was found that they could make the trip in the same time, with considerably less energy than the usual amount; the maximum speed of the car was not so high, but the average was the same, and the amount of energy consumed was considerably less. This, however, was accomplished only with certain motors which had been installed on some of the cars, and would not apply to the usual motors.

DIRECT-CURRENT ARMATURE WINDING.—A patent was issued Dec. 5 to Norman W. Storer on a method of winding armature coils, having for its object to afford a maximum useful magnetic effect without oversaturating the iron between the core slots, or increasing the size of the armature core beyond satisfactory limits. By the usual method of winding direct-current armatures, the turns of wire are located in the core slots in a number of layers, each layer comprising two or more wires placed side by side. In connecting such coils to the commutator bars, it has been usual either to connect each lead from each slot to a separate commutator bar; or, if two or more leads are connected in multiple, those are selected which lie one above the other in the slot. By the present method two or more conductors from each slot are connected in multiple to a commutator bar; but instead of following the practice above referred to, two or more conductors lying side by side in the slot are connected to the same commutator bar. This materially reduces the losses due to eddy currents, since the local magnetic flux intercepted by the wires connected in parallel is only about one-half what it would be if such wires were connected in the same radial plane. This method also enables the employment of deep-core slots, thus utilizing a large number of turns of wire per slot without oversaturating the iron between the slots, and without increasing the dimensions of the armature beyond satisfactory limits.

STORAGE BATTERIES.—Two patents were issued Dec. 5, on storage batteries, one to Charles J. Reed and the other to William W. Hanscom and Arthur Hough. The Reed battery is of the type in which metallic zinc or some other highly positive metal is deposited upon lead or iron in the act of charging the battery. This deposit usually partakes of a crystalline or irregular form, and these crystals frequently become loosened or detached and drop from the plate or electrode to the bottom of the cell. An accumulation of such detached crystals at the bottom of the cell necessarily produces short circuits, thereby materially deteriorating the battery. To avoid such deterioration, the inventor places in the bottom of the containing vessel a plate or plates of carbon or platinum or equivalent electromagnetic material not acted upon by the battery solution. When the particles or crystals of zinc fall on this plate, they are rapidly dissolved by the battery solution, owing to the galvanic action of the local circuit produced by the contact of two dissimilar conductors in an electrolyte. The Hanscom patent is on a method of manufacturing electrodes for storage batteries. Dry powdered litharge is poured into a mold of a cylindrical form adapted to produce a disk-like shape. Sugar and sulphate of ammonia are then mixed with the litharge, after which a plunger is inserted in the cylinder and pressure applied to form the mass into pellets solid enough to handle. The pellets after drying are strung through a central opening on a metallic rod, and a continuous wire is wrapped about the outside, the disks then being subjected to electrolytic action. When the pellets have been reduced on their outer surface and this reduction has extended inward toward the centre for about one-eighth of an inch, the pellets are clamped on a mandrel and rotated while a suitable roller presses against the edge, thus compressing the spongy lead. A sufficient number of pellets are then set in a mold and suitably spaced and molten lead poured to form a frame about them. The heat of the lead is sufficient to melt the edges of the pellets and cause a weld between them and the frame, this weld forming practically an integral of the frame and pellets and removing the possibility of the formation of sulphate of lead between the active material and the frame.

LETTERS TO THE EDITORS.

Magnetic Induction Telegraphy.

To the Editors of Electrical World and Engineer:

Sirs:—We have been making a few experiments in magnetic induction at our college recently, and the local press in reporting the matter gave the impression that we claim this to be the first time these experiments have been made in the United States. Some of the eastern papers in quoting have made the same statement. We are well aware of the fact that the Preece method of space telegraphy is well known to many experimenters in this country, and also that a number of patents along this line have been taken out here. We make no claim whatever to priority in these experiments. Kindly do us the favor to publish this letter in your journal.

CHAS. R. STURDEVANT.

KENTUCKY STATE COLLEGE, LEXINGTON, KY.

Unipolar Dynamos.

To the Editors of Electrical World and Engineer:

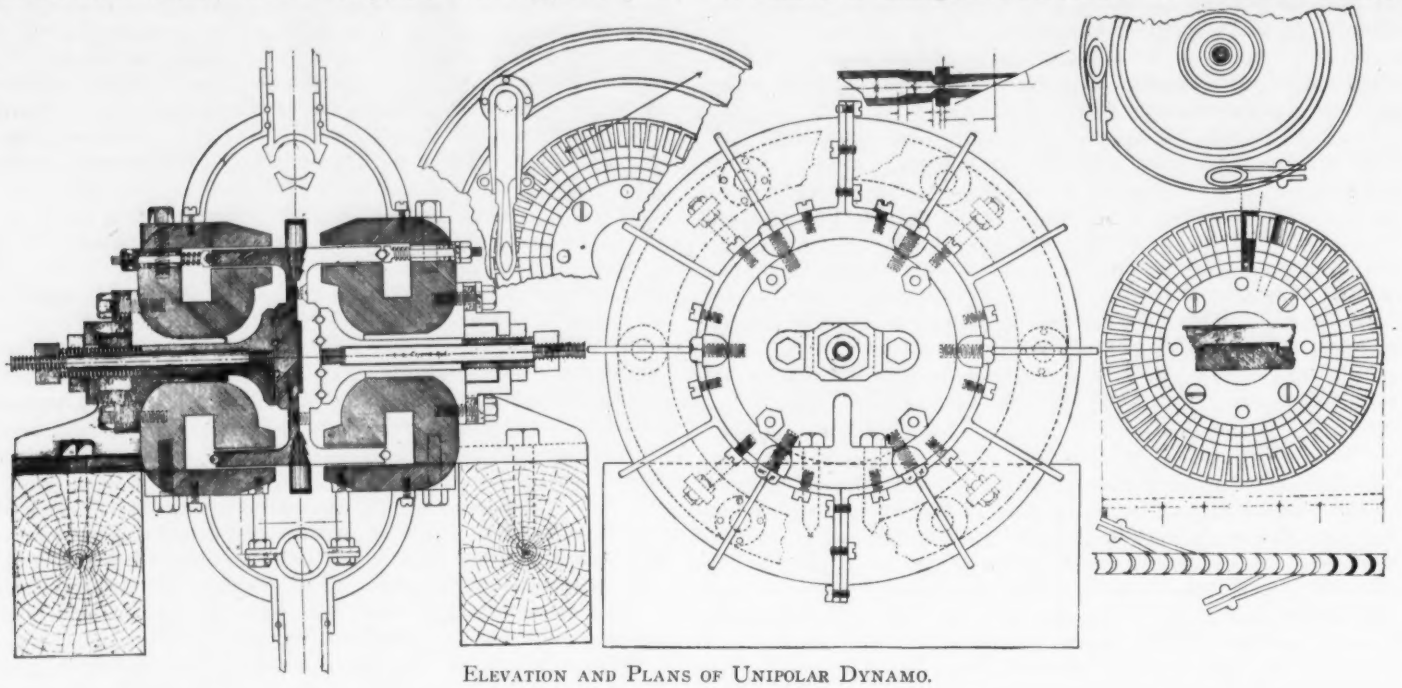
Sirs:—From letters which have recently been appearing, it seems that the unipolar machine is about to have its semi-annual inning.

Mr. Harry Dey, in your issue of Sept. 23, refers to a machine of his design in which the current was to be taken off through ball bearings. He states, however, that he could not reconcile the high amperage with the small contact surface of the balls.

I am sending you sketches of a machine designed by me about two years ago, and although the completed designs have been misplaced, the sketches will suffice to show that current was to be taken off through ball bearings. Experiments made at that time with five-sixteenths and one-quarter-inch steel balls running at about 4000 feet per minute in triangular steel and bronze races, seemed to indicate that the 62 five-sixteenths and 40 one-quarter balls of the outer and inner bearings respectively would carry one-half of the 400 amperes which the machine was designed to furnish. How they would behave at a speed of 800 or 900 feet per second, however, is a matter of conjecture.

By referring to that part of the sketch which shows a section and

elevation of a "proposed continuous pole turbo-generator," it is seen that upon the periphery of the armature are placed the buckets of a DeLaval steam turbine, which is designed to run at 30,000 r. p. m.,



ELEVATION AND PLANS OF UNIPOLAR DYNAMO.

thus generating an amount of current limited only by the carrying capacity of the bearings, and at a pressure of 50 volts.

Assuming the armature to be of steel of an ultimate tensile strength of 225,000 lbs. per sq. inch, it would run safely at this speed, *providing* its gravity axis lay at all times in the axis of rotation.

Notwithstanding the most careful balancing, however, this condition seems almost impossible to attain; and as neither the neat scheme of DeLaval in turning down the shaft in order to allow the mass to rotate about its own gravity axis, nor that of Parsons in surrounding the bearings with concentric sleeves, between which films of oil under pressure are interposed, could be applied to the case in hand, the machine was abandoned.

R. W. LOHMANN.

ITHACA, N. Y.

DIGEST
OF
CURRENT ELECTRICAL LITERATURE.

By CARL HERING.

DYNAMOS, MOTORS AND TRANSFORMERS.

Motor Generators and Synchronous Converters.—EBORALL.—The first part of an article in which he points out the following advantages of motor generators. There is no intermediate apparatus between motor and line, the former being connected directly to the line conductors. The sets can be started equally well from either end with the greatest ease, and by unskilled labor, if necessary. Perfect parallel running without synchronizing; moreover, it is independent of the suitability of the generator engines, nature of line, adjustment of excitation, etc. The switch gear and board are of the simplest possible character. There is a greater flexibility of design of the plant and a greater reliability when running. The character of the machinery an. its management is familiar to the attendants. The direct current side of each set is independent of the polyphase side. Less attendance is required in the substation, which will therefore cost less; the attendance need not be of such a high order. He then begins some notes on the management of synchronous converters. He points out the necessity of interposing step-down transformers between the high voltage line and the converter, and describes the methods of starting.—Lond. *Elec. Rev.,* Nov. 24.

REFERENCE.

Commutator Design and Construction.—ADAMS.—A discussion of the requirements of commutators of direct-current machinery and of the physical properties of the materials used therein. A design is given of a commutator for a 15-hp 220-volt motor with working drawings.—*Amer. Elec.,* December.

LIGHTS AND LIGHTING.

Passenger Car Lighting.—An abstract of a report, made to the Southern and Southwestern Railway Club, on the comparative value, efficiency, cost and practicability of various types of artificial lights for passenger cars. Electric lighting is said to have passed the experimental stage and is favorably commented on. In the United States there are used for railway car lighting 55 per cent. oil lamps, 43 per cent. gas and 2 per cent. electric light. The average cost "per light per hour" is given as 0.007 for "storage straight," 0.083 for "dynamo straight," 0.043 for dynamo and storage and 0.02 for gas. (What the candle-power is, or whether the cost is in dollars or cents, is not stated.)—*Sc. Amer.,* Dec. 9.

POWER.

Additional Apparatus at Niagara.—Of the two large power generating and distributing establishments operating by means of Niagara water power, one, the Niagara Power Company, generates all its power in one style of current, while the other, the Niagara Falls Hydraulic Power & Manufacturing Co., generates various kinds and voltages of current as wanted in the consuming devices, doing away with intermediate transformations and conversions. Descriptions of the new apparatus of the latter company is given. This consists of a number of machines as outlined below. One is a 5000-ampere 185-volt machine, the pecularity of which is the use of two commutators, one on each end. The load is divided between them by a relative motion of the brushholders, the mechanism for which is unusually elaborate; it is illustrated. The division of the load between the two commutators is indicated by a central zero shunt ammeter connected to a Y shunt, the circuits of which are shown in a diagram and explained in full; the output of this machine is consumed in making chlorate of potash. Another interesting machine is a 900-kw Walker single-phase, revolving field alterator of a frequency of 125; on account of its high frequency, it has a very high peripheral velocity, about 7500 ft. per minute; it also consumes an extraordinary amount of energy in field excitation, about 20-kw; the machine has many peculiarities of design; it is used for ordinary electric lighting with house to house transformers. There are just being completed four new 750-kw direct-current machines for 2500 amperes each, at 300

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volts, for the production of aluminum. These are direct-coupled to two pairs of Jonval type turbines, an interesting peculiarity of which is the fact that they are controlled by cylinder gates. Two new pairs of 3000-hp turbines are also ordered. These will drive another machine for chlorate of potash production and three new machines for the production of alkalis from common salt, the electrolytic bath to consist of fused or molten salt instead of a solution, the temperature to be maintained by the current passing through it. The new turbines will be of the inward radial flow type.—*Amer. Elec.*, December.

Power Transmission.—BELL.—An article discussing the practical limitations of long distance and high voltage power transmission. The engineering features are summed up by saying that at present 10,000 to 40,000 volts are being used successfully, the former being well tried and conservative, the latter somewhat experimental at present, verging upon conditions which become troublesome not far beyond that limit; up to fully one hundred miles, no limitations are encountered at customary voltages and frequencies other than those due to the protection of an increased length of line; at still greater distances there are no troubles in sight which good design and careful construction cannot overcome. Commercially, however, the length of the line is limited by its cost, so that longer lines are profitable only for the transmission of a very large amount of power, at low cost of original power and high selling price of the transmitted power.—*Cassier's Mag.*, December.

Dredging Plant.—An illustrated description of the installation of the Bed Rock Dredging Co., which has been in use for two seasons in placer mining near Boise City, Idaho; alternating current and polyphase motors are used for the first time. Current is generated by a 500-volt two-phase alternator, direct-connected to a water wheel, and then transformed by two 200-kw transformers to 10,000 volts three-phase, and transmitted over 15 miles to the scene of the dredging, where it is transformed back to 400 volts two-phase. The dredges are of the ladder or elevator bucket type. One 75-hp motor operates a string of heavy buckets on the ladder of the dredge, controlled by a reversing switch and autostarter. Two other 75-hp motors are direct connected to centrifugal pumps. A 20-hp variable speed motor swings the dredge into position, and another 20-hp motor operates the grizzly and screen, both being controlled by reversing switches and autostarters. How the variable speeds are obtained is not described.—*Eng. and Min. Jour.*, Dec. 2.

Electric Motors for Printing Machinery.—HOLMES.—A short abstract of a paper in which he mentions that the output of a certain printing establishment has increased at least 20 per cent. since the system of driving independent machines by 74 separate electric motors has been adopted. The causes to which this result are due are discussed, but they seem to include nothing new.—Lond. *Elec.*, Nov. 24.

REFERENCES.

Electric Cranes.—The continuation of the illustrated description of recently installed English cranes (Digest, Dec. 9). The simplicity of the controlling apparatus of three-phase motors for crane driving, and their ability to run for long periods without the slightest attention, are pointed out; the three-phase system for cranes which has been largely adopted in Continental Europe is almost unknown in practice in England.—Lond. *Elec. Rev.*, Nov. 24.

Electrically Operated Dredge.—A very brief description of an electric dredge, used in Russia in widening and deepening the channel of the River Volga; three-phase alternating current being used for driving induction motors.—*El'ty*, Nov. 29.

Cost of Steam Raising.—HOLLIDAY.—A long paper read before the English Institution of Electrical Engineers, with numerous diagrams and tables.—Lond. *Elec. Eng.*, Nov. 24; the first part also in Lond. *Elec. Rev.*, Nov. 24.

Engines.—PARSONS.—A reprint of the Lond. *Elec.* abstract of his presidential address, noticed in the Digest Dec. 2.—*El'ty*, Nov. 29.

Steam Engines for Electric Traction Power Houses.—HAGUE.—The first part of an article discussing the peculiar problems imposed by highly variable loads.—*Eng. Mag.*, December.

TRACTION

Conduit Construction in Paris.—CONNETT.—A long, well illustrated description of a system which has been recently installed on an important line, 10.5-km in length. The system differs radically from American practice, the chief difference being the location of the conduit under one of the track rails instead of between the tracks; the slot is rather wide, being 40 to 50-mm, which is thought to be undesirably wide. The construction is fully illustrated; it was carried out at the rate of 100 meters of street or 200 meters of track per day; while the swelling of the wood pavement has not affected the width of the slot, the rails have tilted, as they are not directly supported by a concrete base because the track rests on the conduit. At switches the slot is diverted from the side of the track to the centre; there is also a specially shallow conduit where the line passes over a bridge; as the trolley system is also used, arrangements are made for removing the plow at certain points; the plow does not differ widely from those used in New York.—*St. R'y Jour.*, December.

Method of Testing Rail Joints.—An illustrated description of a new method used in Boston. The resistances of two circuits are balanced against each other by the aid of a telephone as a means of detecting the current. There are three contact poles held in the hand and placed on the surface of the rail, making two circuits, one from the middle pole to one of the outers through the joint, and the other from the middle pole to the other outer through the unbroken rail; these poles are moved along the rail until the telephone shows no current and then the distances between these poles will be proportional to the resistances of the rail, one including the joint and the other with no joint, or, in other words, it will show the resistance of the joint as compared with that of the unbroken rail. The advantages are quickness, accuracy and simplicity; no error is introduced by a continuous current flowing through the rail at the time, as the testing current is an intermittent one.—*St. R'y Jour.*, December.

High Speed Line at Buffalo.—A few notes. The cars between Buffalo and Lockport run between 45 and 60 miles per hour, the distance being about 35 miles. The trolley wire instead of being suspended from brackets is hung from a stranded steel cable which is attached to the brackets.—*St. R'y Jour.*, December.

Berlin.—A note on the new elevated railway. Trial trips are being made; the cars are 11 meters in length, seat 36 passengers and weigh complete 21 tons; four-car trains are run, two "trailers" being in the centre and a motor car at each end.—*St. R'y Jour.*, December.

Automobile.—A short illustrated description of an Austrian electrical coupé, which is driven by a 5-hp motor, geared by spur wheels to the front axle. The battery, which is located under the driver's seat, comprises 42 cells of a capacity of 100-amp. hours, the weight being given as 924 lbs. A distance of 25 to 50 miles can be run with one charge, according to the condition and gradients of the roads traversed. The front wheels have a larger diameter than the rear.—*Ind. and Iron*, Nov. 24.

REFERENCES.

Burgdorf-Thun Three-Phase Railway.—ROCHAT.—A long, well-illustrated description of this line in Switzerland, which has been referred to repeatedly in the Digest.—*St. R'y Jour.*, December.

New York Tunnel Railway.—A reprint of the invitation to contractors issued by the Rapid Transit Board. It is discussed editorially and it is thought that the proposed contract is not sufficiently favorable to induce bids; to build an exceedingly long road in order to carry people long distances at a low rate of fare is not an inviting proposition to capitalists.—*St. R'y Jour.*, December.

Manhattan Elevated Railway.—B. E. GREENE.—A short article of a financial nature, answering criticisms in the daily papers which are claimed to have been unjust.—*Elec. Rev.*, Nov. 29.

Third Rail for the Manhattan Elevated Railway.—A cross-section with dimensions; the rail weighs 100 lbs. per yard and is being drilled for bonding both through the web and through the base.—*St. R'y Jour.*, December.

Earnings and Profits on Manhattan Island.—A long article with diagrams, discussing the transportation earnings of the various lines.—*St. R'y Jour.*, December.

Electric Traction in England.—DAWSON.—A short article of a general nature on the development of electric traction in Great Britain.—Lond. *Elec. Rev.*, Nov. 24.

Surface Contact System.—An illustrated description of the Kingsland system which is to be tried in Wolverhampton, and was noticed in the Digest Dec. 9.—Lond. *Elec. Eng.*, Nov. 24.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

A Small Hydraulic Railway and Lighting Plant.—WOODFORD.—It is possible by running incandescent lamps on the five-wire principle to utilize on the circuits as high a voltage as that commonly used for street railways. The Merrill Railway & Lighting Co., Merrill, Wis., operates a hydraulic station generating 500-volt power, which is

used irrespectively for lighting on the five-wire system and for street railway purposes. The power is generated by four 42-inch New American upright wheels all geared to one horizontal main shaft on which three machines are directly coupled. One of these generates 500 volts and the other two 250 volts each. The power output is steadied and the system balanced by a storage battery.—*Amer. Elec.*, December.

A Lightning Arrester.—KENNELLY.—A description of a simple and convenient form of lightning arrester designed by Mr. W. T. Cook, manager of the Louisville Traction Co., Louisville, Ky. The arrester consists simply of a heavy, bare, grounded wire or bar and two similar bars near it both of which are connected through switches to the overhead wiring. In practice a No. 16 double-covered cotton wire is hung so as to lie over the grounded bar and one of the bars connected with the trolley wire. The 500 volts will not jump through the cotton covering but the lightning discharge will, giving a ready path to ground which is promptly broken by the fusing of the No. 16 wire. Two separate bars connected with the overhead system are used, so that one can be in service while the other is disconnected by means of a switch for safe renewal of the cotton-covered wire.—*Amer. Elec.*, December.

REFERENCE.

Central Stations.—ADAMS.—An illustrated description of the development of the electric central station during the past twenty years.—*Cassier's Mag.*, December.

WIRES, WIRING AND CONDUITS

REFERENCE.

Safety Suspensions for High Tension Lines.—A description, with some of the illustrations, of the system noticed in the Digest Sept. 23. It is said to be used extensively in Germany.—Lond. *Elec. Eng*, Nov. 24.

ELECTRO-PHYSICS AND MAGNETISM.

Inductance of a Portion of an Electric Circuit.—ALLEN.—The first part of an illustrated theoretical article. The inductance (coefficient of self-induction) of a single loop is defined as the number of tubes of induction which are linked with the circuit when unit current flows in it, or as twice the energy stored in the medium with the same current, the latter definition also holding for any whole number of turns. When, however, the inductance of part of a loop is considered, it is necessary to decide which of the induction tubes and how much of the energy are due to the current in that portion of the circuit. He starts from Maxwell's formula for the energy stored in the medium, which holds in general for a closed electric circuit, and "if the point where the vector potential is taken as zero is properly chosen, it is applicable to any part of a circuit." He then considers some special cases and shows that it is not easy to define the self-inductance of one of the branches, or the mutual inductance between two of them. In the case of a main circuit and a voltmeter circuit, where the impedance of the second is high, he defines the mutual inductance as the number of tubes due to the main circuit cut through the voltmeter circuit when the current in the main conductor is reduced from unity to zero, and begins the analytical treatment of this case.—Lond. *Elec.*, Nov. 17.

Electric Waves Through Water.—BRANLY.—A French Academy note on the transparency of liquids to electric waves, which question is of importance for the firing of submarine mines from a distance by means of electric waves. He has tested various liquids and solutions and has found that a layer of "tap water" (presumably meaning fresh water) 8 inches thick reduces the signaling distance to one-fifth of its value in the open air, and that the same thickness of salt water intercepts the waves completely. Sea salt is particularly absorptive, more than the sulphates of zinc, sodium or copper. The wave length, however, makes some difference, as waves from an 0.8-inch coil are completely intercepted, while those from an 8-inch Righi spark are transmitted to the extent of about one-half per cent. by a layer of sea water 8 inches thick.—*Comptes Rendus*, Oct. 30; abstracted in Lond. *Elec.*, Nov. 24.

Secondary Radio-Activity.—P. and MRS. CURIE.—A French Academy note on a new property of radio-active substances. The rays emitted by radium and polonium are capable of communicating a temporary radio-activity to otherwise inactive substances, such as zinc, platinum, bismuth, paper, etc. The phenomenon is allied to phosphorescence rather than to the production of secondary Röntgen rays.—*Comptes Rendus*, Nov. 6; abstracted in Lond. *Elec.*, Nov. 24.

Influence of Becquerel Rays on Spark Gaps.—ELSTER and GEITEL.—A description of the following experiment: When a spark gap, 0.4 inches wide, between a positive knob and a negative disc, is exposed to a radium preparation, the sparks or brushes of the discharge are immediately converted into a glow discharge, a violet glow surrounding the knob. The form of the former discharge was re-established on intercepting the Becquerel rays by means of a plate of lead. When the disc is made of semi-conducting cardboard instead of metal, the gaps become so sensitive that the radium preparation affected the discharge at a distance of over a meter.—*Wied. Ann.*, No. 11; abstracted in Lond. *Elec.*, Nov. 24.

Magnetic Variation of the Peltier Effect.—POCHETTINO.—An account of an investigation of the influence of a magnetic field upon the Peltier effect, under proper consideration of the variation of thermal conductivity exhibited by magnetic metals on magnetization. He used a copper-iron couple consisting of copper and iron tubes soldered to an intermediate silver tube, and found the Peltier effect varying with the magnetization in an irregular way, the variation being independent of the direction of the magnetization.—*Nuovo Cimento*, October; abstracted in Lond. *Elec.*, Nov. 17.

Spark Discharge in a Magnetic Field.—TOEPLER.—An illustrated account of an investigation of the influence of a magnetic field upon brush discharges. It has the effect of crowding the stratifications together and also of displacing them laterally with respect to each other. An unstable brush discharge is converted into a spark discharge by a magnetic field.—*Wied. Ann.*, No. 11; abstracted in Lond. *Elec.*, Nov. 24.

Resistance of Moving Electrolytes.—AMERIO.—An account of a repetition of Edlund's and Bosi's experiments; they had found that the resistance of an electrolyte is altered by motion. He confirms Bosi's observations and shows that this is a concentration phenomenon the various solutions used all increasing in conductivity when concentrated. If the electrolyte concentrates about the anode and the liquid flows from the anode to the cathode, the anodic concentration affects a larger portion of the liquid in the tube and the resistance falls. Whereas, if the electrolyte concentrates about the cathode, the concentrated portion is rapidly washed away by the flowing liquid.—*Nuovo Cimento*, October; abstracted in Lond. *Elec.*, Nov. 17.

Electrical Savart Figules.—DE HEEN.—A description of the following experiment: Lichtenberg's figures were first obtained in the usual way by electrifying a plate of resin and sprinkling it with powdered sulphur. If then a number of "centres of ether disturbance," such as flames or electric brush discharges, are placed symmetrically about the plate, the sulphur arranges itself into a symmetrical figure, which for two centres is a straight line normal to the line joining them, and for three centres it is in the form of three lines meeting in a point. The geometrical figure obtained may be defined by saying that the locus is formed by points equidistant from two centres, the common distance being less than the distance from any other centre. He bases his explanation on a supposed "ether blast."—*Comptes Rendus*, Nov. 6; *L'Eclairage Elec.*, Nov. 18; abstracted in Lond. *Elec.*, Nov. 24.

ELECTRO-CHEMISTRY AND BATTERIES.

Electrolytic Treatment of Complex Sulphide Ores.—COWPER-COLES.—The continuation and conclusion of his paper (Digest, Dec. 2) giving an illustrated description of his process. The part of his process concerning the zinc consists in roasting the ore sweet, in a specially constructed furnace, washing out the soluble zinc sulphate with water, leaching out the remaining zinc with a solution of zinc sulphate containing free sulphuric acid, purifying the strong zinc sulphate thus obtained by scrap zinc to deposit the copper, and electrolyzing the enriched and purified solution between lead anodes and iron or aluminum cathodes. The chief difficulty met with in obtaining good deposits of zinc, is the formation of zinc sponge, the causes of which phenomenon are discussed at some length with references to other investigations. As pointed out in an editorial comment on the paper, it is now fairly well admitted that the deposition of spongy zinc is due to the electrolyte becoming basic, and that the best chance of obtaining and maintaining a good deposit is to keep the solution slightly acid. He then discusses the cost of depositing zinc and the weight of zinc deposited and gives in a diagram the results of careful laboratory experiments made to determine the actual weight deposited as compared with the theoretical, with varying percentages of free acids. The manufacture of zinc white is briefly discussed. The parts of his process concerning the lead and silver are

then described. The lead is leached out with caustic soda and either electrolyzed to recover lead as metal, or precipitated with carbonic acid to give white lead. Silver remains in the residual ore, and is leached out with cyanide and recovered by electrolysis. He finally gives a diagram of his process which shows the different stages at the various operations, also the different cycles for the zinc, zinc oxide, metallic lead and white lead. Editorially it is remarked that not all the difficulties appear to have been overcome and that in the present state of experimental knowledge of the treatment of such ores, some simpler even if less complete process, should be preferred. When the zinc has been removed and recovered, even at a very modest profit, then the lead with the silver, freed from the incubus which hinders its smelting, should pay well for treatment by ordinary methods.—Lond. *Elec.*, Nov. 17, 24.

Chlorine and Alkali Process.—KERSHAW.—An article on the Hargreaves-Bird electrolytic process which has been subjected to a thorough trial for four years and is now to be exploited experimentally. The special form of cell in which the electrolysis of the sodium chloride solution is carried out, is briefly described; it consists of a central anode chamber, flanked on either side by cathode chambers which contain steam and carbonic acid gas, in place of the usual salt solution; the separating walls of these three divisions of the cell are combined diaphragm-cathodes which are impermeable to the salt solution contained in the anode chamber, but allow the electric current to pass and to carry with it the electrically charged ions of sodium; on arriving at the outer surface of the diaphragm cathode, these sodium ions are said to discharge their electricity, react with the steam and carbonic acid gas, and produce hydrogen and a solution of sodium carbonate. Various reports of experts are noticed and criticised. He considers the process to be one of the most promising for the electrolytic production of soda and bleach.—Lond. *Elec. Rev.*, Nov. 24.

A note on the same process. The works to be erected will contain 250 cells, each producing 37 tons of soda ash per year and 68 tons of bleaching powder containing 37 per cent. of available chlorine, a total output of over 9000 tons of ash and over 16,000 tons of bleach per year.—*Ind. and Iron*, and Lond. *Elec. Eng.*, Nov. 24.

Electrolysis of Fused Zinc Chloride.—SCHULTZE.—An account, in abstract, of an experimental investigation. When fused zinc chloride is electrolyzed with carbon electrodes, chlorine is evolved at the anode and hydrogen at the cathode, and the electrolyte is rendered cloudy by the separation of a bluish-gray substance; after a time the evolution of hydrogen stops, zinc is deposited instead, and the separation of the bluish-gray substance ceases. The same phenomenon was observed when a piece of the purest zinc was introduced into fused zinc chloride, so that the cloudiness of the latter cannot be due to the carbon electrodes, but is explained to be due to the fact that zinc chloride retains traces of water which probably react with zinc forming zinc oxide and hydrogen, and that when the action continues there is an excess of zinc beyond that required for ZnO.—From *Zeit. Anorg. Chemie*, abstracted in *Jour. of Chem. Soc.*, reprinted in Lond. *Elec. Eng.*, Nov. 24.

Liquefied Ozone.—A reprint from a daily paper of a statement that Prof. O'Neill has succeeded in liquefying ozone. The various uses of this liquefied ozone are enumerated, the chief one being in surgery. It is said to be produced by passing pure oxygen through tubes immersed in liquid air to reduce its temperature, subjecting this to a great pressure, and passing high voltage electric discharges through it, after which it is still further compressed, and is cooled by means of liquefied air until the liquefied gas is produced.—*El'ty.*, Dec. 6.

Units of Measurement.—MOON.—The conclusion of his article (Digest, Nov. 25). He refers to Heaviside's suggestion to do away with the multiple 4π in many electric formulas and to make the intensity of magnetization of the same value as the intensity of the field. He proposes to go a step further and do away with the multiple 8π and to start the electromagnetic system of units from "unit induction equals unit stress across unit area." In this way the constant π would be eliminated from a number of formulas in constant use, only to be introduced into a few seldom used formulas for the action of magnets at a distance. The values of the other units of the electromagnetic system, resulting from this definition, are given in a table. As unit of supply the meg-unit of work could be taken, that is, nearly 6-kw hours, which would make the prices of gas and electric light more comparable. He develops some formulas in the forms which they would have in the proposed units. The introduction of the new units would necessitate the recalibrating of existing volt and amperemeters; but as the proposed units are nearly decimal multiples of those at present used, the alteration would be slight. A great difficulty, however, would be experienced in the alteration of the resistance coils. The electrostatic units he proposes to base upon unit stress per unit area, giving unit e. m. f. per unit distance.—Lond. *Elec. Rev.*, Nov. 24.

Wehnelt Interrupter.—ROTHE.—A note in which he states that if the resistance in the circuit diminished gradually, the electrolytic stage persists to much smaller values than when a lower resistance is inserted suddenly. The true limiting resistance of the electrolytic stage can only be ascertained by a gradual change of the resistance; every e. m. f. has its own limiting resistance. Incandescent lamps light up when the electrolytic stage is past, or in the electrolytic stage when an inductance is introduced.—*Comptes Rendus*, Oct. 30; abstracted in Lond. *Elec.*, Nov. 24.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Pollak-Virag Telegraph System.—A brief description of this system, which has already been described more fully in the ELEC. WORLD AND ENG. Tests have recently been made between Chicago and other cities and they are claimed to be the first made outside of Budapest. Tests over a looped circuit have shown considerably higher speeds over longer lines than the tests from Budapest to Berlin. From Chicago to Buffalo and back, 1040 miles, a speed of 2400 words a minute was obtained with 20 volts positive and 20 negative. A test between Chicago and New York failed, but is to be repeated.—*West. Elec.*, Dec. 2.

Cable Lines to South Africa.—A map and brief description of the various cables around Africa over which news from Natal is transmitted. There is a line along the west coast from Cape Town north and one on the east coast from Durban. The total capacities of the lines is not more than 25 to 30 words a minute. The cable rate from New York to Ladysmith is $1.23 per word.—*Elec. Rev.*, Nov. 27.

Printing Telegraph.—An illustrated description of recent improvements of the zerograph of Kamm (Digest, Dec. 11, 1897). The chief improvement is that the number of electromagnets required to operate it has been diminished, and the weight which formerly propelled the synchronizing arm has been replaced by a spring. It is said that the instrument can now be worked to 15 or 20 words per minute with but little practice.—Lond. *Elec.*, Nov. 24.

REFERENCES.

American Telephone Practice.—MILLER.—In this continuation of his series of articles he discusses some of the details of testing. The principle and electrical operation of the Wheatstone bridge are described as well as the use of shunts for galvanometers.—*Amer. Elec.*, December.

Army Telegraph Corps in South Africa.—Some illustrations with a very brief description from *Leslie's Weekly.*—*Elec. Rev.*, Dec. 29.

Telegraphy in Africa.—A description of the construction of the Uganda State Railway telegraph lines in tropical Africa, where many difficulties are to be surmounted.—Lond. *Elec. Rev.*, Nov. 24.

Relay for Wireless Telegraphy.—A reprint, with illustrations, of the Lond. *Elec. Rev.* article, noticed in the Digest Dec. 2.—*El'ty*, Nov. 29.

Cable Steamer.—A description of the new cable ship which was built in England for a German cable company, and was noticed in the Digest Dec. 9.—Lond. *Elec.*, Nov. 17.

MISCELLANEOUS.

Electrical Progress.—S. P. THOMPSON.—The first part of his presidential address to the English Institution of Electrical Engineers, in which he discusses some of the tendencies which manifest themselves at present in the electrical world. He describes the recent progress in telegraphy and repeats a former suggestion for subterranean or submarine cables, which is, to construct them with a series of self-inductive artificial leaks of high resistance distributed all along its length, "to combat its distributive capacity." For interior wiring he advocates an uninsulated or semi-insulated return conductor and claims that with the introduction of armored conduits for interior wiring the prejudice which demands a double insulation will disappear. For power generation and distribution the present practice of large power stations, and distribution at high voltages over large areas, is said to be the only economical one. He points out the superiority of alternating over continuous currents and of the three-phase over the three-wire system. He discusses the parallel running of a number of alternators and the danger arising when the

field magnet of any one loses its magnetism through any failure of the exciting current. He considers the following device of Leblanc for preventing such disasters as one of the most important inventions of recent years. The revolving field magnets are provided with an "amortisseur," which is a simple and substantial squirrel cage of copper embedded in the pole pieces of the field magnets, each pole being perforated with six slots to receive six stout copper rods, all of which are short-circuited by being connected together by two external rings of copper. This device, which is analogous to that used in the rotors of polyphase motors, simplifies the operation of synchronizing and gives to the alternator the property that on the failure of excitation from the ordinary source, the automatic action of the eddy currents comes into play and prevents the disastrous reactions. He then discusses the application of electric traction to heavy railways.—Lond. *Elec., Elec. Rev., Elec. Eng.,* Nov. 24.

Automatic Magnet Coil Winding.—A description of the new works of the Varley Duplex Magnet Co., Jersey City. The Varley magnets are wound with bare copper wire, the layers being insulated from one another by means of thin sheets of paper and the turns of each layer being insulated by a silk thread wound in with the copper. The coils are wound by means of automatic machines, each of which is capable of turning out from 1200 to 1500 per day of 10,000 turns each. The machines automatically wind in the copper and silk and slip in the paper sheets at the proper intervals, the sheets being automatically cut a little wider each time so as to cover the increased circumference. They also count the turns and stop automatically when the proper number has been wound. Each machine winds a tube or rod of coils aggregating one foot in length and these tubes are afterwards sawed into coils of the proper length.—*Amer. Elec.,* December.

Electricity in Australia.—REI.—An article on the activity in the electrical field in Australia. In New South Wales there are 16 central stations and 70 isolated electric light plants. Progress in Sydney is described at some length. Electric traction is increasing rapidly, some of the installations being made by the General Electric Co. Only a very small portion of the electric power is used for motors. The activity in electrical engineering in Queensland, Victoria and in Adelaide is briefly outlined.—*West. Elec.*. Dec. 2.

Alleged Electrical Gas Process.—A long article on a process in which weak water gas is converted into a gas of high heating and illuminating power by passing through one or more chambers which are said to contain electric generators of the "thermopile" class. Several companies founded in the west to exploit this process have failed. Now there are attempts to introduce the process in Passaic and Plainfield, N. J. The process is criticised very unfavorably at some length.—*Eng. News,* Dec. 7.

REFERENCES.

Electric Progress.—HOUSTON.—An article giving some historical data on the development of electric science and engineering from early times till to-day.—*Cassier's Mag.,* December.

Electrolytic Method of Sharpening Files.—A short illustrated description of a recently patented electrolyte receptacle for that purpose. (See also Digest, Nov. 25.)—*El'ty,* Nov. 29.

Electric Flash Light Device.—An illustrated description of an electric flash light lamp for photographic purposes.—*Sc. Amer.,* Dec. 2.

Velvril.—REID.—An abstract of the paper noticed in the Digest Dec. 9.—Lond. *Elec. Rev.,* Nov. 17; reprinted in *El'ty,* Dec. 6.

Biographical.—An account, with portrait, of the life and work of the late Hamilton Young Castner, the well-known chemical engineer. —*Eng. and Min. Jour.,* Oct. 21.—A German account of his work, in which he is spoken of as one of the ablest representatives of electrochemical engineering.—*Zeit. fuer Elektrochemie,* Nov. 16.

New Book.

A HISTORY OF WIRELESS TELEGRAPHY, 1838-1899. By J. J. Fahie, New York, 1899: Dodd, Mead & Co. Cloth, 12mo. 325 pages. Illustrated. Price, $1.60.

To many people who have but recently heard of telegraphy without wires, the fact that there is already a history of the subject will seem surprising; but as Mr. Fahie intimates in the title to this interesting little historical résumé, we have to go back at least to 1838 to find some of the beginnings. As a matter of fact, Mr. Fahie himself cites practical suggestions dating as early as 1795, but it is rather the practical art than the mere idea or theory that now presses upon the attention of the public. Media of various tenuity have been tried, including the earth, water and the air, and we have now found the useful commercial wireless art with ether, thinnest of them all. That we can go beyond ether is not at this moment within the bounds of arguable probability.

Mr. Fahie divides his book into virtually two parts, the possible and the practicable, and he has been industrious to gather and cite the references and literature. Perusal of the book brings out the point that the references of real value are the latest ones, most of all, perhaps, those which he has thrown into the appendix, Marconi's English patent, Hertzian papers by Lodge, and part of Branly's paper on the discovery of the principle of the coherer. Mr. Fahie is evidently much impressed with what Mr. Marconi has accomplished, and fittingly devotes much of his time and space to the work of that successful inventor. We should have been glad, indeed, if he had given Mr. Marconi even a little more space, namely, enough to show some of the apparatus in perspective cuts rather than merely by the rather poor outline drawings made sometime ago. However, this will probably be remedied in later editions, such as may soon be expected. The book is prefaced by the portraits of Oersted, Ampere, Faraday, Henry, Clerk-Maxwell, Hertz, Branly, Lodge, Righi, Preece, Willoughby Smith and Marconi, as the "Arch Builders of Wireless Telegraphy," a selection which we modestly believe we could improve upon. But then the book is not ours, but Mr. Fahie's, to whom we are much obliged for it.

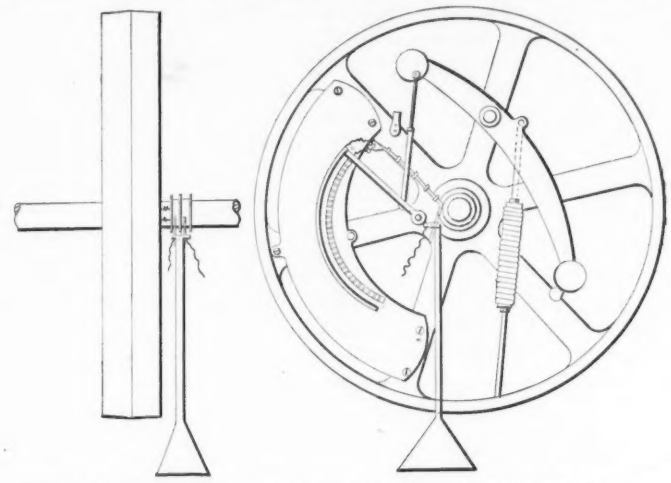
BOOKS RECEIVED.

POWER TRANSMITTED BY ELECTRICITY. By Philip Atkinson, A. M., Ph. D. New York: D. Van Nostrand Company. 241 pages, 94 illustrations. Price, $2.00.

Voltage Regulator.

BY E. E. CLOCK.

The accompanying illustration shows a combination inertia and synchronous voltage regulator which has given excellent results in practical test, and which for incandescent lighting is all that can be desired. It differs from a relay apparatus in that it does not depend on a rise in e. m. f. to operate it, and unlike the principle of engine



COMBINATION INERTIA AND SYNCHRONOUS VOLTAGE REGULATOR.

governing, does not depend upon the very thing it is trying to correct for its action.

An engine governor must have a change of speed before it can act, and a relay voltage governor must have a change of e. m. f. before it can act. This governor acts upon a different principle from either, for as the speed changes it changes the exciting current, and can be adjusted to increase the voltage with decreasing speed. This regulator is as efficient on the gas engine as on the water wheel.

A Small Enclosed Compound Engine.

With the general advent of higher steam pressures, the utility of the small compound engine is becoming more evident. When carefully designed, its use insures increased steam efficiency. To meet the demand for engines of this description, to be used principally for auxiliary work, such as dynamo and fan-driving, the B. F. Sturtevant Company, of Boston, has brought out a line of sizes of the

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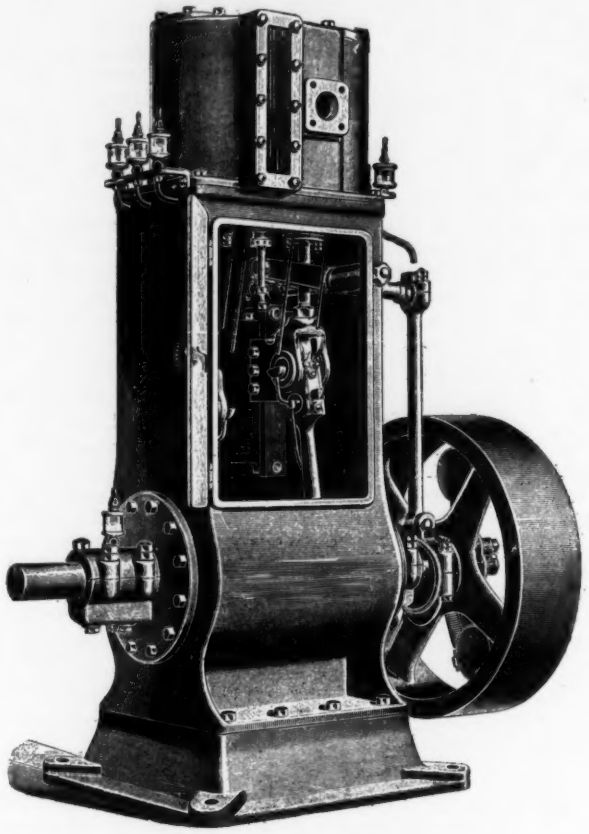
general type here illustrated, and ranging from 2¾-5x2½ to 6½-11x 5½. The strokes are short, and high speed is consequently possible, the maximum ranging between 750 r. p. m. for the smallest size to 425 r. p. m. for the largest size. The maximum net horse-power under 150-pounds boiler pressure ranges from 7½ to 50-hp, according to the size.

The cylinder ratio is approximately as 1 to 3, both the high and the low pressure cylinders being comprised in a single casting, which contains the intermediate receiver, and which is independent of the rest of the frame, being attached thereto by bolts. This feature simplifies repairs and reboring. Two piston valves are used, one upon either side of the casting and between the cylinders. They



ENCLOSED COMPOUND ENGINE.

are operated in unison from a common yoke beneath. This in turn is actuated by the forked rocker, through which one piston rod passes, and which receives its motion through a ball-and-socket joint from the eccentric.

The governor is designed for close regulation, and the engine shaft is extended upon the opposite side, so as to take an independent band wheel. In order to meet prevalent conditions under which this type of engine must work, the frame is entirely enclosed, but the interior is rendered accessible through a large swinging door on the front, and a smaller one on the back. The journal boxes are provided with continuous oiling devices, and formed in part by the circular plates, are bolted to the sides of the engine frame. The removal of one of the boxes provides the means of taking out the shaft.

Particular attention has been given to the matter of continuous oiling devices, and all moving parts are arranged for positive supply. Although primarily designed for pressures of 150 pounds, these engines are good for 200 pounds pressure, and even higher.

Adams-Bagnall Railway Arc Lamp.

The Adams-Bagnall Electric Company, of Cleveland, is preparing to introduce a new type of arc lamp, shown in the accompanying illustrations. It is designed to meet the requirements of a demand for a satisfactory lamp to be used on street railway circuits of 450 to 600 volts, and is intended to be connected in series. It is furnished with one external rheostat for each group of four or five lamps as required, or can be furnished with an auxiliary rheostat for each lamp.

The case of the lamp is made of solid hard rolled sheet copper which makes the lamp entirely weatherproof. The feeding mechanism is operated by an electromagnet. The metal used for the core and heads of the magnet, also the armature, is of cold drawn steel of the highest permeability. The armature is hinged on knife edges, which are of tool steel. From this it will readily be seen that the friction is reduced to a minimum. Any sudden movement of the armature is checked by means of a self-lubricating air-pot with a graphite plunger. The lamp is of the clutch feeding type, and the clutch is reduced to simplicity itself, having no mechanism that can get out of order. It operates directly on the carbon and will not allow it to slip through under any condition.

FIG. 1.—EXTERNAL RHEOSTAT FOR RAILWAY ARC LAMP.

There are no sliding contacts in the lamp, which will regularly burn 100 hours at one trimming and under favorable conditions this may be increased to 125 hours. It is so arranged that after the first run

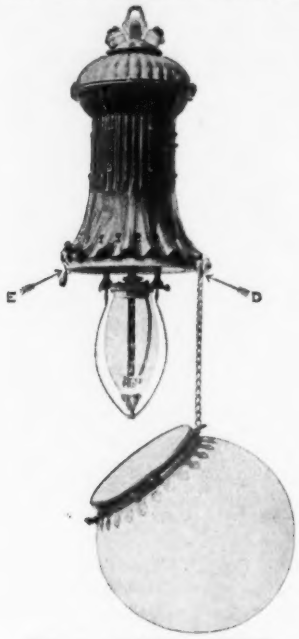


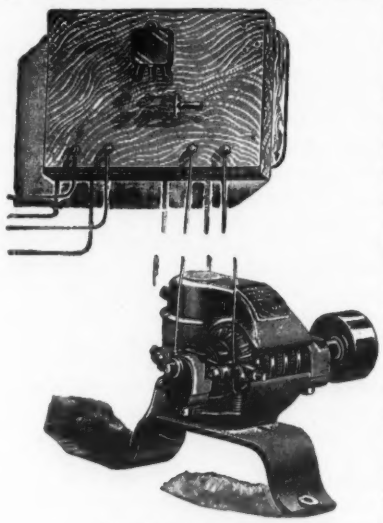
FIG. 2.—GLOBES LOWERED FOR TRIMMING.

FIG. 3.—GENERAL VIEW OF RAILWAY ARC LAMP.

there is enough of the upper carbon left for use as the lower carbon for the second run, so that one carbon ½-inch by 12 inches will be sufficient for each trimming.

Igniting Apparatus for Gas, Gasoline and Petroleum Engines.

An expert of high standing recently said that "Ninety per cent. of all trouble with gas engines is due to the spark." Besides, the batteries in use for this purpose are expensive to keep up. In view of these facts the Dayton Electrical Manufacturing Company, of Dayton, O., have developed and put on the market the Apple sparking devices of different types. The standard form is illustrated herewith, and consists of a starting cabinet and small dynamo built especially for this work. The starting cabinet consists of two 40 ampere-hour storage cells (with semi-dry filling enabling same to be shipped to any point fully charged), spark coil and switchboard properly wired so that any one can connect up the outfit to engines.



IGNITING APPARATUS.

This company make other types of igniting outfits. Among them is one for igniting from 110-volt circuit without destroying the points in the engine or grounding the circuit.

NEWS OF THE WEEK.

Financial Intelligence.

THE WEEK IN WALL STREET was one in which the weakness of "industrials" was put to the test in a striking manner, chiefly on account of the dissensions revealed as existing in the management of American Sugar. The decline in that stock had its effect, which was accentuated to some extent by President McKinley's criticisms on trusts and the Addyston Pipe decision in the United States Supreme Court, interpreted as operating against any combination for harmonious working, even such as that between the General Electric and Westinghouse Companies. Moreover, the growing needs for money in trade helped to depress stocks, so that altogether the market was kept on a lower plane, and one which in truth is much healthier than that upon which the big booming of earlier months was done. During the week, on sales of 3,254 shares, Western Union was off ½ to 87¼. On sales of 8100 shares, General Electric went off 5½ to 124. Manhattan Elevated was off 3¾ to 101⅞ on 97,125 shares; Metropolitan Street Railway, 9½ to 183½ on 21,155 shares; Third Avenue off 7 to 145 on 1836 shares, and Brooklyn Rapid Transit off 4⅞ to 87⅛ on 378,859 shares. These figures give a good idea of the general trend of the market. In Boston, American Bell Telephone closed at 347-350; Erie, 105-106; New England, 142; Michigan, 100; Mexican, 3⅛-3¼; Mass. Electric Railways, 18½ common, 75½ preferred; Boston Elevated, 100¾. In Philadelphia, Traction closed at 96½; Union Traction, 39½; American Railways, 5½; Elec. Co. of Am., 13⅞; Elec. Storage Battery Co., 113¾-114 common, 117¾-118 preferred; Penn. Elec. Veh., 9-9¼ common, 4-4⅛ preferred. In Chicago, National Carbon, common, was quoted at 16⅞-17; Edison 6s at 100½; Union Loop, 103; Union Traction, preferred, 79; Met. Elevated 4s, 95⅜. In the New York outside market, Elec. Axle Light and Power closed at 6¼-6½; Elec. Boat, common, 27-28, preferred, 42-44; Elec. Vehicle, 63-68 common, 95 preferred; N. Y. Elec. Veh. Transportation, 10½-11¼; Illinois, 2-2¾; New England, 6¼-7; Nat. Gramophone, 70-72; St. Louis Street Railways, 24-30 common, 93 preferred; Otis Elevator, 25-27 common, 90-91 preferred.

NEW HAVEN LIGHTING CONSOLIDATION.—The plans of the new United Illuminating Company, of New Haven, Conn., referred to last week, are now announced. The New Haven Electric Company will receive share for share to the amount of $400,000 in outstanding stock, and $1,000,000 in first mortgage 40-year 4 per cent. bonds, equal to $250 in bonds and $100 in stock for each share of electric company stock. The Bridgeport Electric Light Company will receive $250,000 in new stock and $625,000 in bonds, or at the same rate as the New Haven Company, the Bridgeport company having $250,000 stock now outstanding. In the case of the Stratford and West Haven Companies the franchise rights merely have been purchased. The securing of the large property of the New Haven Gas Light Company is doubtful. The practical result of the combination is to substitute for the present $650,000 outstanding stock of the two companies, $1,625,000 in bonds and $850,000 stock of the new company, with $200,000 as new stock paid in as cash by stockholders of the new organization. The United Illuminating Company was chartered under the State laws last spring with a minimum capital stock of $200,000. The incorporators were James E. English, president of the New Haven Electric Company; John W. Alling, of the law firm of Alling, Webb & Morehouse, and Herbert C. Warren, of the banking house of H. C. Warren & Co.

BELL TELEPHONE BONDS.—With regard to the proposed changes in Bell telephone capitalization, the Boston News Bureau says: We understand that the new American Telephone & Telegraph Company bond indenture is not limited as to amount, except as regulated by its capital under New York laws. New York laws permit the issue of mortgage bonds to the same amount as the capital stock issued, and also, in addition, the issue of collateral trust bonds to an amount equal to the share capital issued. At first the American Telephone & Telegraph Company will have issued about $50,000,000 of stock, or twice $25,886,000 Bell Company stock, which will permit of the issue of about $100,000,000 in bonds. We understand that the stockholders exchanging Bell shares for two of American Telephone & Telegraph Company will have the right to subscribe to new stock at par, one additional share for each two shares of long distance stock. The new bonds will bear interest at 4 per cent. and run for thirty years, and $5,000,000 are being prepared for issue. The balance may be issued as the money for extension is required.

UTICA LIGHTING CONSOLIDATION.—A copy of the agreement of consolidation of the Utica (N. Y.) Electric Light Company and Trenton Falls Electric & Power Company, forming the Utica Electric Light & Power Company, has been filed with the Secretary of State. The new company will furnish light, heat or power, and light the streets of Utica, Rome and the villages of Prospect, Trenton, Holland, Patent, Oriskany, Whitesborough, New Hartford, Clinton, Frankfort, Ilion, Mohawk and Herkimer, and other villages and towns of Oneida and Herkimer Counties. The amount of capital stock is $1,000,000. The directors are Henry D. Pixley, Daniel N. Crouse, T. Solomon Griffiths, H. Jesse Brayton, William E. Lewis, of Utica; William G. Phelps, of Binghamton, and Joseph Fox, of New York City.

BROOKLYN RAPID TRANSIT BONDS.—With reference to report that Brooklyn Rapid Transit contemplates a bond issue, President Rossiter is quoted as saying: "No bonds have been issued except in connection with reorganization of the Kings County system." Counsel for the company stated that $7,000,000 had been provided for under the reorganization plan, $5,000,000 of which has been issued. The remaining $2,000,000 will be left in the treasury for improvements. Bonds are payable in 1949 and are secured by first mortgage on property and franchises of company. Interest on these bonds amounts to $200,000 annually.

MANHATTAN DIVIDEND.—The board of directors of the Manhattan Elevated Railway met this week and declared the regular quarterly dividend of 1 per cent. The vice-president and general manager, Alfred Skitt, said that preparations for the change in motive power was proceeding satisfactorily. The excavation for the great power house in East Seventy-fourth Street was steadily going forward, despite the difficulties created by the bed of solid rock encountered. He felt confident that part of the railway would be under electric operation within one year.

SHEET BRASS AND COPPER.—The combination of leading sheet brass and copper manufacturers in the Naugatuck Valley, Conn., noted some time ago, will go into effect January 1. The companies which combine are the Ansonia Brass & Copper Company, capital $1,500,000; Coe Brass Manufacturing Company, Torrington, Conn., capital $1,000,000; Waterbury Brass Company, capital $400,000. Mr. Chas. F. Brooker, of the Coe Brass Company, will be president. These three companies employ 3,500 men.

MONTANA POWER.—The Montana Power Company, of Butte, has transferred to the Montana Power Transmission Company, a New Jersey corporation, all its property, including 1900 acres of placer ground in Beaverhead and Silver Bow counties. The consideration paid was $1,775,000.

BONDS PURCHASED.—Winthrop Coffin, of Perry, Coffin & Co., Boston, is in Indiana, and states that his bank, in connection with N. W. Harris & Co., of Chicago, has purchased the bonds of the interurban electric lines between South Bend, Mishwaka, Elkhart and Goshen.

CHICAGO UNION TRACTION.—It is understood that the Yerkes interest in Chicago Consolidated Traction will be paid for by an issue of 4½ per cent. bonds by Union Traction. The price to be paid for the controlling interest is believed to be between $45 and $50 a share.

DIVIDENDS.—The Commercial Cable Company has declared a quarterly dividend of 1¾ per cent. and a bonus of 1 per cent., payable January 2. The National Gramophone Corporation has declared the usual monthly dividend of 1 per cent. payable December 16.

Commercial Intelligence.

THE WEEK IN TRADE has been marked by little of the slackness that usually comes at this season of the year, particularly in electrical work outdoors, when the frozen condition of the soil forbids new planting of poles or the opening of roadbeds for tracks and subways. A very large demand is reported for arc and incandescent lamps for the holiday season, and one has but to walk through the retail store districts of any city to perceive that lighting is indulged in upon the most liberal scale. At the present moment the factories that make fan motors are getting ready for their spring work, and inquiries in various quarters develop the fact that 1900 is looked forward to as a brisk year in the fan business at advanced prices. Meantime the era of prosperity has done much to develop a number of newer electrical industries hardly yet to be regarded as staple, but requiring in the aggregate an immense amount of labor, material and finished product for which excellent prices can generally be obtained, because it is not yet subject to standard quotations. As to general trade, Dun's review says that the approach of a new year usually brings so much of hesitation in business that the small shrinkage this year is surpris-

ing. Probably never before have the productive forces of the country been so largely covered by contracts at this date, insuring employment and profit far into the coming year. This results, not from any mere speculative excitement, but from actual demands for consumption running far beyond the producing capacity heretofore, and pushing it to remarkable expansion. The increase in foreign trade has been insignificant compared with the increase of domestic payments through the clearing houses. For the week the payments were 20.3 per cent. larger than last year, and 38.1 per cent. larger than in 1892. As Bradstreet's points out, the last month of the year has opened auspiciously, finding trade and industry generally well employed, demand treading close upon and even passing supply, labor troubles averted in some instances by widespread advances in wages, of small importance except in one or two cities, and with the general level of values of staples at the highest point reached for eight years past. Holiday demand has opened well, and collections from retail trades, therefore, show some improvement. The rise of staple values, a notable feature in the month of November, has apparently been projected into the current month. Ten out of thirteen classes of products advanced, but less irregularity in the general movement is noted than for some time past. Bradstreet's reports 220 failures in the United States during the week, against 177 for the previous week, and 237, 292, 381 and 313 for the corresponding weeks of 1898 to 1895. About 89 per cent. of the total number of concerns failing had capital of $5000 or less, and 5 per cent. had from $5000 to $20,000 capital. Metals remain strong. Heavy steel rail, Eastern mill, was quoted at $35, or more than twice what it was this time last year. Copper is fairly easy at 17 cents, and lead, New York, 4.60 cents.

EDISON CEMENT.—Details have been given from time to time in this department as to Mr. Edison's intention to start up cement works, on the lines of some of his iron ore crushing work. We may now announce that a company of capitalists, headed by Mr. Edison, has purchased the John W. Cline farm at Stewartville, five miles from Phillipsburg, N. J., and has obtained options on several adjoining farms. The company has been prospecting for cement rock for some months past, and Mr. Edison has been there several times. It is said that an excellent quality of rock has been found, and that a million dollar plant, with a capacity of 5000 barrels a day, will be erected at once. Much of the apparatus has already been contracted for, and the use of electric motors will be liberal.

OUR TROLLEY CARS ABROAD.—Reports from England state that American manufacturers are about to receive contracts for about 1500 trolley cars for various European electric roads. Twelve hundred cars will be required for Great Britain and France. There will also be extensive purchases made in this country of equipments for the proposed extensions of the Barcelona and Bilbao street railways. It is stated that at least 300 trolley cars will be required for these Spanish roads, in which the Rothschilds are largely interested. As the English, French and Spanish lines will need 1500 cars in all, this will mean an expenditure in the neighborhood of $4,500,000. The Jackson & Sharp Company, of Wilmington, Del., has just been awarded a contract for 100 trolley cars which are intended for use on the grounds and vicinity of the Paris Exposition. Despatches from Philadelphia announce that J. G. Brill & Co. have received an order for a number of electric trucks to be used by the Street Railway of Barcelona, Spain. This is said to be the first contract of its kind placed in this country since the beginning of the war with Spain. The Brill Company has also on its order books orders for 200 electric trucks from the street railway company of Sydney, Australia, 12 trucks for a street railway company in Berlin, 12 trucks for Tver, a town about 150 miles from Moscow, Russia, in addition to other orders amounting to 1,000 trucks for different foreign countries.

AUTOMOBILE DEVELOPMENT.—Two new automobile companies were incorporated last week under New Jersey laws—the Woods Motor-Cab Company, of Detroit, and the Woods Motor-Cab Company, of Washington, D. C. In each case the capitalization is placed at $500,000, and the charters are also similar, in specifying that the objects are to "carry on general transportation business of passengers and merchandise, and the purchase and manufacture of cabs, hacks, vehicles, etc." The Woods Motor Vehicle Company, of Chicago, recently incorporated with a capitalization of $10,000,000, and which now controls the Chicago plant of the Fischer Equipment Company, is affiliated with these two new companies. The same interests which are back of those companies are said to have a close and friendly connection with the General Carriage Company of New York City, the stock of which underwent a sensational rise of late.

MR. JAS. I. AYER, manager of the heating department of the Simplex Electrical Company, Cambridgeport, Mass., informs us that among other foreign orders received last week for electric heating apparatus was a large one from Siam—a further indication that American goods are appreciated everywhere.

DEMAND FOR CATALOGUES.—The French Minister at Lima, Peru, S. A., recently informed his Government that several French electrical engineers and mechanics resident in Peru had solicited the aid of the legation for the purpose of obtaining catalogues relative to the articles in their special line of business. These requests refer principally to lighting materials, wires, flexible cords, sockets, lamps, generators for the transmission of electric power, telegraphic and telephonic apparatus, etc. The same official writes that there exists in Lima a demand for catalogues of wood-working machinery.

ALUMINUM CONDUCTORS.—A report was recently in circulation, in fact, it found its way into print, that the Telluride Power Transmission Company, of Colorado, were abandoning the use of aluminum for electrical conductors. Mr. L. L. Nunn, the general manager, writes us that the statement is entirely untrue. He informs us that they have recently placed an order with the Pittsburg Reduction Company for 250 miles, two carloads of which have been shipped, the remainder to follow as quickly as it can be got out. They are also endeavoring to contract for 600 miles more for early spring, the only difficulty being as to date of delivery. Mr. Nunn claims for his transmission company that it is the oldest in America, and that the plants have been in good shape and successful operation for nearly ten years.

EXPORTS OF ELECTRICAL MATERIAL FROM NEW YORK.—The following were the exports of electrical material from the port of New York during the week just ended: British Guiana—11 cases electrical material, $215. British East Indies—41 cases electrical material, $5777. British Possessions in Africa—7 cases electrical machinery, $3956; 52 cases electrical material, $3234. British West Indies—64 cases electrical material, $2314; 1 case electrical machinery, $48. British Australia—39 cases electrical material, $688; 7 cases electrical material, $426. Central America—2 packages electrical material, $48. Canada—3 cases electrical material, $106. Dutch West Indies—1 case electrical material, $1150. French Possessions in Africa—7 cases electrical material, $1015. Hamburg—3 cases electrical material, $1172; 14 cases electrical material, $328. Havre—117 cases electrical material, $8521. London—23 cases electrical material, $584; 9 cases electrical machinery, $335. Porto Rico—2 packages electrical material, $29. Rotterdam—1 package electrical material, $40. Southampton—23 packages electrical material, $1694. United States of Colombia—3 packages electrical material, $85. Venezuela—12 packages electrical material, $628.

THE ADDYSTONE PIPE CASE has attracted a great deal of attention in trade circles, and the stock market has taken it as likely to affect the General Electric-Westinghouse patent pooling arrangement. But the United States Supreme Court decision does not seem to touch that point. It deals rather with a trade agreement. This case arose out of an action brought under the Federal anti-trust act. An injunction was asked for to enjoin six corporations engaged in the manufacture of water and gas pipe from continuing to do business under an agreement by which they had divided the territory of the United States among themselves and by which they had arranged to fix prices. Members of the combination provided for auctioning off the right to make bids for supplying with pipe cities not in allotted territory, the successful bidder to meet no opposition from other members of the trust, or if other bids were made none of them to be higher than that of the company to which the award had been made by the combination. When bids were asked in territory allotted to members of the combination no bids were made except under the supervision of the company in charge of that territory under the agreement. Two questions were raised, viz.: First, whether the clause in the constitution regarding the regulation of interstate commerce applied to individuals; and, second, whether, if the clause should be found to apply, the combination amounted to a strangling of interstate commerce. This question was decided by the Supreme Court in the affirmative. Next, the question was raised whether there was any substantial difference in cases in which by agreement among themselves the parties chose one of their number to make a bid for the supply of the pipe for delivery in another state and agreed that all the other bids shall be for a larger sum, thus practically restricting all but the member agreed upon from any attempt to supply the demand. The defendants intended to make the very combination and agreement which they, in fact, did make, and they must be held to have intended the necessary and direct result of their agreement. The court said that it had no doubt that where the direct and immediate effect of a contract or combination among particular dealers in a commodity was to destroy competition between themselves and others, so that the parties to the contract or combination might obtain increased prices for themselves, such contract or combination amounted to a restraint of trade in the commodity even though contracts to buy such commodity at the enhanced price were continually being made. Total suppression of the trade is not necessary in order to render the combination one in restraint of trade.

Special Correspondence.

NEW YORK NOTES.

New York, Dec. 12, 1899.

MR. CAMPBELL SCOTT, who for several years has been the general sales agent of the C & C Electric Company, has been made secretary and general manager of his company.

BETTER PAY FOR RAILWAY EMPLOYEES.—The Brooklyn Rapid Transit Company has decided to increase the pay of the starters, conductors and motormen after Jan. 1. What the amount of increase will be cannot be learned at this time.

MR. CHARLES McLAUGHLIN, of J. H. Bunnell & Co., 76 Cortlandt Street, has just returned from an extended pleasure trip through the southern states. Mr. McLaughlin has had a busy and eventful year, and was in need of the rest and recreation he has just enjoyed.

THE FRANCHISE TAX.—A despatch from Albany states that the prevailing impression that corporations taxable under the franchise tax act would pay their first taxes during the year 1900 is a mistake, as the statute will not be in full operation, so far as results are concerned, before January, 1901.

REDUCTION OF TELEPHONE RATES IN BROOKLYN.—Within the past week the New York & New Jersey Telephone Company has reduced its rates for telephones in private houses in Brooklyn. Heretofore the minimum rate has been $40 a year. Now it is but $24. This rate allows 300 calls, one a day, Sundays and holidays excepted. For each additional call 10 cents is charged. Under the old order the $40 minimum rate allowed 500 messages.

LECTURE ON THE DYNAMO.—The fifth lecture of the course for journeymen electrical workers, under the auspices of the New York Trade School, First Avenue, Sixty-seventh and Sixty-eighth streets, will be given at 8:15 o'clock in the evening of Dec. 22. The subject of the lecture will be "The Dynamo, or Generator." Mr. Arthur A. Hamerschlag will explain the construction and operation of the machine.

ELECTRIC CURE FOR CONSUMPTION.—The medical staff of St. Luke's Hospital in this city, it is stated, are much interested in the experiments of Prof. F. Crotte in the cure of tuberculosis by electrical means. It is stated that the results thus far obtained are encouraging. Little can be learned of the apparatus and method employed in the experiments, but it is stated that the charge from a static machine conveyed to the lungs of the patient through sponges. Prof. Crotte states that by the static electricity he conveys to the affected organism formic aldehyde, which kills the disease microbes.

DEMAND FOR ELEVATED RAILWAY ENGINES.—An interesting matter has developed in connection with the proposed installation of electric power on the elevated railways in this city. When this great task is accomplished several scores of locomotives will be left on the company's hands, and it was feared that little or nothing could be obtained for them. But the Manhattan Railway Company, it is said, has already received applications for more engines than it has and at fair prices. The applications have come from as far away as St. Petersburg and are chiefly from American contractors who are building new roads.

REDUCTION OF CABLE RATES.—The Commercial Cable Company has made a reduction of 5 cents a word on messages "via Bermuda" to the West Indian islands, except Jamaica and Puerto Rico. It is stated that the $5,000,000 increase of capital stock of this company, just approved by the stockholders, is to be used for the laying of a new cable. No information, however, can be obtained as to the points the new cable will touch. It will be recalled that the Commercial Cable Company has for several months been making an effort to obtain from the United States government permission to lay a cable from a point in the United States to Cuba. This privilege has, however, been steadfastly denied up to the present time, the opposition coming, it is stated, from Western Union interests.

AUTOMOBILE SHOW.—Never, at any of the previous shows, has there been such a demand for space as that which has met the managers of the Cycle and Automobile Show, to be held at Madison Square Garden, New York, during the week following Jan. 20, 1900. In previous years it has been customary for exhibitors to hesitate about taking space until they found out just what they had to show, and solicitors were usually sent out to induce concerns to show their goods. With very little solicitation every space on the ground floor, as well as 30 per cent. of the balcony spaces, have already been taken for the show of 1900. In fact, it will be impossible to accommodate any more automobile concerns that may desire to exhibit heavy vehicles, for anything which is now given space must be light enough to carry up on the balcony. One automobile concern, which will exhibit its runabouts, declares its vehicles to be light enough to be carried in position.

POSTAL FACILITIES.—The American Trade Press Association, in the ineests of its vast clientage of subscribers, readers and advertisers, is pushing vigorously the campaign for a new post office in New York City and the extension in general of the present postal facilities. The resolutions adopted by the association on Dec. 7 are as follows: Whereas, The postal facilities of the city of New York have long been insufficient for the requirements of the business, resulting in loss and inconvenience to all classes of the business community, particularly to publishers of newspapers, who are affected both in the delay in the distribution of their publications and the receipt of their mail; Whereas, The present New York post office is entirely inadequate to the demands of the service, being now overcrowded to a degree which is hurtful to the health of the employees and discreditable to the government, the men being compelled to work under conditions to which we as private employers would be unwilling to subject our employees; and Whereas, It seems impossible that any sufficient improvement in the postal service of New York City can be attained without the building of a new post office, Resolved, That the American Trade Press Association heartily indorses the bill for the erection of a new post office in New York City which is about to be introduced in Congress, and urges its members to use all the influence of their journals to promote its passage. Resolved, That a copy of this preamble and resolution be sent to the Postmaster General, Postmaster Van Cott, the postal committees of the senate and house of representatives and to our senators and representatives. Charles T. Root, David Williams, E. C. Brown, M. T. Richardson, J. M. Wakeman, Committee of the American Trade Press Association.

THE SPRAGUE ELECTRIC COMPANY, on Dec. 16, will remove its offices to Nos. 527 to 531 West Thirty-fourth Street, New York City, where it will have larger quarters and better facilities for conducting its increasing business.

THE YORKVILLE ELECTRIC CONSTRUCTING COMPANY, of 26 Vesey Street, New York, are placing on the market a very neat little novelty in the shape of a toy automobile. They also make miniature lamps, scarf pins and other novelties. Mr. Wm. Jacobs, formerly of the H. E. Plass Elec. Cons. & Supply Company, is manager of this new concern.

UNDERWRITERS' MEETING.—The annual meeting of the electrical committee of the Underwriters' National Electric Association was held at the Underwriters' board rooms in the Mutual Life Building, Nassau Street, on Tuesday, Dec. 12, when the general invitation sent out to municipal inspectors and other interested was cordially accepted. The meeting was continued on Wednesday. There was an average attendance of from 40 to 60, and the discussions were participated in actively and generally. During the first day the chief topics were approved devices, etc., while on the second day the chosen leading question was the grounding of transformer secondaries.

ELECTRICAL TRADES SOCIETY.—A very successful annual meeting of this useful body was held at the Astor House on Tuesday, Dec. 12, at 2 p. m., when about a score of representative concerns participated. The main subject brought up for discussion was the adoption of an "advance credit report" system, such as has in fact already been adopted by some of the members; and the result of the discussion and of the data brought forward was to convince all present that the plan was a good one to adopt. It will go into effect at once under the supervision of Mr. A. P. Eckert. The election of officers resulted in the unanimous choice of the following ticket: President, R. E. Gallaher, N. Y. Insulated Wire Company; vice-president, C. P. Geddes, Sprague Electric Company; directors, with these, E. R. Gilmore, Western Electric Company; J. P. Marshall, J. A. Roeblings Sons' Company; H. A. Reed, Bishop Gutta Percha Company; J. B. Peck, W. R. Ostrander & Co.; G. T. Patterson, Stanley & Patterson; secretary, A. P. Eckert, Safety Insulated Wire & Cable Company.

NEW ENGLAND NOTES.

Boston, Mass., Dec. 9, 1899.

THE GENERAL ELECTRIC COMPANY is preparing to erect a large addition to its present steel foundry at Lynn. The new building will probably cost $65,000.

COMBINATION IN CONNECTICUT.—Announcement has been made that the United States Illuminating Company, of New Haven, Conn., known at the time of its incorporation last spring as the New Haven Illuminating Company, will take over soon the properties of the New Haven Electric Light Company, the Bridgeport Electric Light Company, the Bridgeport Illuminating Company, the Stratford Gas & Electric Company, the Westhaven Power Company and others. The deal embraces a proposition to consolidate companies whose combined capital stock is over $1,500,000.

PENNSYLVANIA AND OHIO NOTES.

Philadelphia, Pa., Dec. 11, 1899.

MR. PETER A. B. WIDENER, the traction manager of this city, has purchased 36 acres of land at Logan, a suburb of Philadelphia, on which he intends to erect and endow a home, hospital and school for crippled children at a cost of $2,000,000. The institution will be known as the Widener Industrial Home for Crippled Children.

CLOSE OF THE NATIONAL EXPORT EXPOSITION.—It is stated that after paying all expenses the National Export Exposition, which closed its doors on the night of Dec. 2, cleared $100,000. The success of the exposition is almost without precedent in this country, for, unlike other expositions, it has never had to bond its buildings to cover the deficit. It has been the most useful object lesson in commerce ever illustrated in the history of the country. During the two months and a half that it has been open about 1,250,000 people have visited it, and many of these came from distant points. The International Commercial Congress, which was in session during the last three weeks of October, was attended by 350 foreign delegates, representing 40 nations. In addition to this, delegates were registered from 200 chambers of commerce of the United States. It is probable there will be another exposition next year.

Pittsburg, Pa., Dec. 9, 1899.

MR. MORRIS MEAD, the chief of the electrical department of this city, who is chairman of the executive committee of the International Association of Municipal Electricians, has concluded arrangements to have the annual convention of that organization take place in this city next September.

COMBINATION OF INDEPENDENT TELEPHONE INTERESTS.—The various independent telephone companies of western Pennsylvania, eastern Ohio and West Virginia held a meeting in this city last Wednesday for the purpose of combining their interests under the name of the Tristate Telephone Company. A temporary organization was effected and Mr. J. H. Shopp, of the Freeport Telephone Company, was elected president, with Mr. E. P. Van Kirk, of the Elizabeth Telephone Company, as secretary. The meeting decided to exclude the Federal Telephone Company from this exchange. Another meeting will be held in this city next week.

Cincinnati, O., Dec. 9, 1899.

SAMUEL J. WICK, superintendent of the shops of the Electric Railway Equipment Company, which are located at Reading, Pa., has been paying a visit to the Cincinnati headquarters.

THE LAWTON-BEATTIE COMPANY has just finished the electrical equipment for the Admiral café in Main street. In some respects the installation is unique. There are more than 10 miles of wiring in one room, and 28 circuits. Mirrors and a unique electric chandelier are artistically combined.

MR. C. B. HUMPHREYS, local manager of the Westinghouse Company, has returned from New York where he has been giving testimony in an important suit. This company is putting in a new 800-kw generator for the Newport, South Covington & Cincinnati Street Railway Company.

MANAGER A. M'CALLUM, of the Electric Railway Equipment Company reports a heavy increase in domestic orders, principally from the Pacific coast, and largely for poles. Some good orders have been received also from Massachusetts. Many inquiries have come from abroad, there being some $150,000 in contracts in prospect from Europe.

THE NEW SWITCHBOARD for the Walnut Hills Telephone Exchange will be ready for cutting in subscribers on Dec. 23. Superintendent W. H. Robinson, of the construction department, is making the necessary changes with as little inconvenience as possible to subscribers. All the department boards are to be replaced with the new ones, the central office coming last.

THE BULLOCK COMPANY is advertising for bids to extend the main building of that already mammoth new concern 200 feet. This will make the main building 500 feet long and 101 feet wide. The tremendous volume of business that has come to the firm from all parts of the world during the last six months has almost overwhelmed it, and this addition was imperative. The extension will be rushed through with the utmost despatch.

MR. T. J. CREAGHEAD, of the Creaghead Engineering & Electric Company, states that business is booming. This company has just secured the contract for the overhead equipment of the Indianapolis & Greenfield (Ind.) Electric Railroad, the grading of which is about completed. The line will be 17 miles long and it is expected to begin operations some time in the spring. The motors are to be furnished by the Steel Motor Company, of Cleveland.

THE ELECTRIC APPLIANCE COMPANY.—One of Cincinnati's most enterprising and flourishing new industries is the Electric Appliance Company, which is under the management of Mr. A. F. Maish, paying teller of the Equitable National Bank. Associated with Mr. Maish, and in charge of the practical work, is W. B. Churcher, an electrical engineer. The company has a half dozen new appliances in process of patenting, and just now is closing up some big contracts for equipping dental and medical institutions.

MEETING OF GENERAL ELECTRIC DIVISION MANAGERS.—The meeting in New York City the coming week of division managers of the General Electric Company will mark an important epoch in the history of that corporation. Mr. W. F. Hays, of the Cincinnati district, will leave here Sunday night. In addition to Mr. Hays there will be present at the meeting C. B. Davis, of Boston; S. F. Barbour, from San Francisco; Major Gen. Irving B. Hale, from Denver (who has just returned from stirring adventures in the Philippines); A. J. Giles, from Atlanta; E. D. Mullen, from Philadelphia; C. T. Hughes, of New York, and B. E. Sunny, from Chicago.

Cleveland, Ohio, Dec. 9, 1899.

THE CLEVELAND TELEPHONE COMPANY is preparing plans for another city exchange, to be called Cheshire. Several new exchanges have recently been completed and will be put in operation in the near future.

M. MONTANGE, representing the Enterprise & Electra Company, of Paris and Brussels, and M. Cahen, representing the Alexandria Tramway Company, of Alexandria, Egypt, in company with Mr. G. Courally, of New York, were in Cleveland several days last week calling on manufacturers of electrical equipment. The foreigners are back of street railway enterprises in their respective countries and are figuring on buying a large amount of equipment.

MESSRS. HORSBURGH & SCOTT, of Cleveland, manufacturers of steel and rawhide gears, are enjoying quite an extensive patronage from manufacturers of electric motor vehicles. A member of this firm remarked the other day that as a rule the motor vehicle manufacturers are experimenting with rawhide gears, which are altogether too light for the work required of them, and not appreciating this fact, there is more or less complaint on this score. He claims that if properly constructed and of sufficient weight, the rawhide gear will wear fully as long as the steel gear, at the same time possessing the advantage of being absolutely noiseless.

THE WILLIAMS-ABBOTT ELECTRIC COMPANY, of Cleveland, is at work on a complete telephone equipment, with 500 instruments for the first instalment, for the Meadville Telephone Company, of Meadville, Pa. This exchange, it is claimed, will possess all the advantages claimed for the central energy system. By an especially devised switch in the magneto, a circuit is closed in hanging up the receiver, flashing an incandescent lamp in the exchange, thus notifying the operator that the subscriber has finished. This renders "ringing-off" unnecessary. The device is the invention of Mr. W. J. Barr, who is associated with the Williams-Abbott Company.

MR. C. E. WOODS, president of the Woods Motor Vehicle Company, of Chicago, has been in Cleveland for the past week endeavoring to interest Cleveland people in a project to form a company to handle Woods' carriages in this vicinity, and to operate automobile cabs in Cleveland and other leading cities. S. H. Rogers, formerly with the Brush Electric Company, is in charge of the Cleveland end of the plan, and he states that it will undoubtedly be consummated. Mr. Woods has withdrawn from the Automobile Carriage Supply Company, which proposed to handle carriages, conduct a club house, riding school and repair shop. The company is now offering for rent the large property which it had fitted up in a magnificent manner.

TO ENLARGE A POWER HOUSE.—Directors of the Cleveland Electric Railway Company met last Monday and decided to erect an extensive addition to the Cedar Avenue power house. Plans are being made and contracts for the new machinery and equipment will be let in the near future. It was also decided to purchase 100 additional motor cars and 50 open cars, to be ready for delivery April 1. During the past year this company has made a record for purchasing new equipment which has never been equalled by a company in the west. In all, 150 new cars of the latest pattern were purchased at an expense of over $400,000. The last of this order, 40 cars, will be delivered within the next two weeks. By a piece of shrewd business policy the company stipulated when the original order for motors was placed, that it was to have an option of 100 more at the same price, providing they were ordered within a year. Since the purchase was made the price on motor cars has increased greatly and the type used cost at present about $400 more than they did at that time; consequently by taking advantage of the option, the company saves something like $40,000.

THE PELTON ENGINEERING COMPANY, Cleveland, representatives in this vicinity for the Eddy Electric Manufacturing Company, has recently completed the installation of a modern power transmission plant for the Dangler Stove & Manufacturing Company, of this city. It consists of a 200-kw Eddy generator, operating at 500 volts, a 300-hp Allis Corliss engine and Babcock & Wilcox smokeless stoker furnaces. There are 12 motors in the various departments, from 5 to 85-hp. There is a circuit breaker on each motor. A 110-volt lighting generator is operated by an independent motor. The switchboard was designed by the Pelton Company. Thus far the plant shows a saving of 50 per cent. over the old belt drive. The company is also increasing the plants of a number of Cleveland concerns. Four of the five factories of the American Steel & Wire Company are receiving additional equipment. A 100-kw Eddy generator has recently been put into the plant of the Eberhardt Manufacturing Company, and a 60-kw generator with 50 arc and 300 incandescent lamps for the local plant of the American Bicycle Company. The Pelton Engineering Company is making some extensive experiments with a steam turbine motor.

WESTERN NOTES.

Chicago, Ill., Dec. 9, 1899.

MR. W. R. MASON, representing the Siemens-Halske Electric Company in St. Louis, visited Chicago this week.

THE CONSTRUCTION DEPARTMENT of the Western Electric Company, Chicago, has closed a contract for wiring 1600 lights and erecting two switchboards for the McCormick Harvester Works, of Chicago.

MR. GEORGE P. REX, secretary of the Columbia Incandescent Lamp Company, of St. Louis, Mo., is visiting Chicago, this week, in the interests of his company. He reports a great increase in business, the factory being compelled to work night and day in order to keep up with the demand for lamps.

FOR PROTECTION OF GRIPMEN.—Mayor Harrison is again taking up, through the law department, the matter of vestibules on street cars to protect gripmen and motormen. There was a vestibule clause in the original but invalid fender ordinance. The mayor believes that while the fender portion of the ordinance was invalid the vestibule clause holds good.

WIRE WORKS LEAVE EVANSTON.—E. C. Lott, general manager of the American Steel & Wire Company, has issued orders for the removal of the wire-weaving machines at the McMullen Woven Wire Company's plant in Evanston to DeKalb, Ill. The McMullen plant was bought by the company about a year ago. Two hundred men are employed, and the plant is estimated as being worth $100,000.

ELECTRICAL EQUIPMENT FOR STEEL WORKS.—The contract for the electrical machinery and appliances for the new Sharon steel works, now in process of erection, has been awarded to the Siemens-Halske Electric Company, of Chicago. Among the apparatus called for are two generators of 600-hp each, making an aggregate of 1200-hp. The work of erecting 50 new houses for the Sharon Steel Company is nearing completion.

ARRESTED FOR ROBBERY.—A conspiracy to rob the Siemens & Halske Company was discovered a few days ago and three men were arrested and locked up at the Desplaines Street police station charged with conspiracy. One of the men made a confession, it is said, implicating the others and explaining a scheme through which thousands of dollars' worth of copper and brass goods were removed from the factory of the company at Fourteenth Street and Robinson Avenue.

TROLLEY RATE WARFARE.—Tickets on the Calumet Electric Railway are selling at two for 5 cents. An order issued by General John MacNulta, receiver for the Calumet Company, was the cause of the cut in traffic prices. While General MacNulta minimizes the rate war, the new movement is understood to be a retaliation upon the South Chicago Company, better known as the "Red Line," because of its refusal to allow the Calumet Company the use of its tracks on the Ninety-second Street bridge, which spans the Calumet River.

RIVAL AUTOMOBILE COMPANY.—The Illinois Electric Vehicle Transportation Company, which has heretofore enjoyed a monopoly of the cab service of the city, will soon have a rival. The Woods Motor Vehicle Company, of which C. E. Woods is president, is preparing to enter the field, and as a starter 25 cabs and broughams will soon be running about the streets in active competition with the Illinois company. Mr. Woods states that the number of vehicles will be increased until 200 are in service and ready for hire.

RAILWAY BUSINESS.—The statement of the business of the South Side Elevated for November makes a better showing than that of any other month since the reorganization of the road in February, 1897, with the exception of October this year. The average number of fares collected daily in November was 69,972, as against 73,793 in October. The November average, however, shows an increase of $10,715, or 18.09 per cent. over November, 1898. Gross earnings of the Chicago Union Traction Company during November were $608,836.45, as compared with $563,710.43, the gross earnings of the North and

West Chicago Street Railway systems during the corresponding month last year. That is an increase of $45,126.02, or about 8 per cent., of which $30,350.67 was earned by the West Side lines and the other $14,775.35 by the North Chicago. Traffic on the Metropolitan Elevated during November averaged 90,000 passengers daily, as compared with 74,000 for the corresponding months of last year.

MR. S. W. MOON, who is well and favorably known in the independent telephone field, has resigned the position of general manager of the American Telephone Company, of Chicago, Ill., to take the active management of the recently incorporated Swedish-American Telephone Company, of the same city. Mr. Moon is one of the pioneers in the independent telephone movement and has also been interested in other electrical lines. He is the president of the LaClede Battery Company, of Kokomo, Ind., and is now treasurer and general manager and one of the largest stockholders of the Swedish-American Telephone Company. The new company will manufacture a complete line of telephone apparatus, making a specialty of the Lidberg transmitter and receiver, on which some very broad patents were recently granted. In recognition of Mr. Moon's efficiency and faithful services as general manager of the American Electric Telephone Company, Mr. P. C. Burns, the president, rewarded Mr. Moon in a very handsome and substantial manner. The employees of the American Company presented Mr. Moon with a magnificent gold watch and chain as a token of their esteem and friendship.

Milwaukee, Wis., Dec. 9, 1899.

CONDUCTORLESS CARS.—The Milwaukee Electric Railway & Light Company is operating its system, in Racine, without conductors on the cars and the city has drawn up an ordinance to force the company to have conductors on all cars.

MR. EDWIN F. PIERCE, formerly interested in the Wisconsin Electrical Construction Company, has severed his connection with this company and has gone into the manufacture of special high grade electric fixtures for the retail trade. A most modern shop has been equipped at 108 Mason Street.

ELECTRIC LIGHTS IN BEAVER DAM.—The common council of Beaver Dam has granted to T. D. Lawrence, who represents a syndicate, a franchise to construct and operate an electric light plant, which is to maintain from 60 to 75 arc lights for the street lighting and after 18 years of service and payment of stipulated rentals by the city the plant is to become the property of the city. The new company is to purchase the entire plant and equipment of the present electric light company, which has been in operation for 15 years. It is also to furnish power for various purposes.

MESSRS. ROHN AND MEYER have just completed the installation of an isolated electric light plant for the National Knitting Company, of this city. A 40-kw Northern dynamo, direct connected to a Skinner engine, supplies current to 40 Adams-Bagnall enclosed arc lamps and to 400 incandescent lamps. The same firm has also closed a contract for the enlargement of Mr. William Bicker's residence isolated electric light plant. The contract includes a 60-cell, 200 ampere hour storage battery, a 50-ampere booster and a complete switchboard; also the equipment of an electric Turkish bath.

TAX STATEMENTS.—The Milwaukee Electric Railway & Light Company and the Milwaukee Light, Heat & Traction Company have filed their tax statements for the year ending Dec. 1, 1899. The Milwaukee Electric Railway & Light Company's statement shows gross cash receipts, $1,977,193.16 and tax at 4 per cent, $79,087.73. The Milwaukee Light, Heat & Traction Company's statement shows gross cash receipts, $232,500.19, and tax at 2 per cent $4650. The Milwaukee Electric Railway & Light Company owns the lines in the city of Milwaukee and the lines to Whitefish Bay, to North Greenfield by way of National Avenue, to Wauwatosa and to South Milwaukee. The Milwaukee Light, Heat & Traction Company owns the suburban lines to Wauwatosa, Waukesha and Racine and also the local lines in the city of Racine.

Indianapolis, Ind., Dec. 9, 1899.

CO-OPERATIVE ELECTRIC LIGHT PLANT.—The citizens of Kokomo have organized the Mutual Electric Light Company. Practically every business man in the city is interested in the co-operative plan to erect a plant to light the city, residences and business houses. The action is a result of the recent advance in the price of light by the existing company.

ELECTRIC RAILWAY FRANCHISE.—The county commissioners of Jackson County have granted Daniel Leslie and A. W. Moore, of Indianapolis, a franchise to build an electric railway through the county. The road is to extend from Columbus to Salem, and will be known as the Columbus, Brownstown & Salem Electric Railway. The promoters are granted three years in which to complete the road before forfeiture.

HALF FARE FOR STANDING PASSENGERS.—On account of the lack of sufficient cars and the overcrowding of the number in service it is urged that the council of Indianapolis pass an ordinance requiring the conductors on the Indianapolis Street Railway Company's cars to rebate any passenger who is unable to get a seat with a half-fare ticket, the half-fare ticket to be good for another stand-up ride with transfer privileges, and two such tickets to entitle the bearer to a ride with a seat.

AN EASTERN INDIANA ELECTRIC LINE.—A company has been organized at Fort Wayne to build an electric railway from Hicksville, Ohio, to Marion, Ind. Pennsylvania capitalists are interested with the Fort Wayne promoters, and it is said there is nearly half a million behind the project. Applications for franchises are being filed in the counties through which the line is to run. The company will be known as the Indiana & Ohio Traction Company. The officers are: J. H. Simonson, president; J. D. Old, vice-president; William Kaugh, secretary, and John W. White, treasurer.

TELEPHONE RATES REDUCED.—The local telephone company at Rochester voluntarily reduced the rate on all its toll lines from 25 to 15 cents. It has lines to all the postoffices in the county, and it is arranging to run a wire into a farming community wherever half a dozen patrons can be secured. The company charges $1 per month for residences and $2 for offices. It has over 300 instruments in service now. The Central Union made three attempts to enter the field in competition with this home company, but without success. Once the Central Union secured right of way to the corporation line, but it could come no further.

St. Louis, Mo., Dec. 9, 1899.

THE KINLOCH TELEPHONE COMPANY has notified the mayor of Belleville, Ill., of its acceptance of the franchise recently granted it by the city council to operate a telephone system. It also filed the bond required by the ordinance.

PROPOSED INCREASE OF STOCK.—The stockholders of the Laclede Gas Light Company will hold a meeting Jan. 22, to vote on a proposition to increase the capital stock of the company from $10,000,000 to $11,000,000 by the issue of $1,000,000 of common stock.

A PETITION from farmers representing 3500 acres of farming lands along the Halls Ferry road will soon be presented to the St. Louis County circuit court, asking that an electric railway be built out the Halls Ferry road to Black Jack, Florissant and Cross Keys.

THE BELL TELEPHONE COMPANY OF MISSOURI, of St. Louis, filed certificate of acceptance at Jefferson City Nov. 29 of the general laws of Missouri relating to corporations and extending the time of its corporate existence 100 years from the 3d day of December, 1899. The capital stock of the company is $2,000,000.

San Francisco, Cal., Dec. 3, 1899.

THE GRANT'S PASS LIGHT & POWER COMPANY, of Grant's Pass, Ore., has been sold to Ralph E. Moody, of Portland, Ore., who represents a syndicate of capitalists. The new company, which will soon be incorporated, will spend $10,000 in making improvements.

WIRELESS TELEGRAPHY IN HAWAII.—Mr. F. I. Cross was recently in San Francisco, after a trip to the eastern states in the interest of his Hawaiian system of wireless telegraphy. He hopes to have all of the Hawaiian Islands connected by wireless telegraphy next spring. Marconi advised Mr. Cross to install his apparatus.

THE TRUCKEE RIVER GENERAL ELECTRIC COMPANY, which is erecting a water power electric station near Floriston, Nevada, recently awarded the contract for two 750-kw generators to the Westinghouse Electric & Manufacturing Company. Transformers are also included in the contract. The voltage on the 30-mile transmission line to Virginia City, Nevada, will be 22,000 volts. Power will be supplied at the Comstock mines upon the completion of the generating station.

THE POSTAL TELEGRAPH COMPANY.—It is gossip on 'Change here that the entrance of J. W. Mackay into the directorate of the Southern Pacific Railroad Company is part of a deal by which Mr. Mackay lends his millions to the support of Mr. Huntington in return for railroad aid to the Postal Telegraph Company. The contract between the Southern Pacific and the Western Union expired one year ago. Since then the railroad company has made objection to the bill rendered it for services by the Western Union, and the contract has not been renewed. Mr. Mackay discovered a chance to increase the business of the Postal Company, and, it is said has made arrangements to have the Postal company succeed to the railroad business as soon as the proper wire facilities can be secured. This would give it access to all parts of California, and would greatly increase its business.

SOUTHERN NOTES.

Richmond, Va., Dec. 9, 1899.

NEW POWER HOUSE IN RICHMOND.—The James River Construction Company, of Richmond, Va., is about to erect a steam power house for the purpose of operating an electric railway in the city. The construction and equipment of the power house will cost $135,000. The Riter Conley Manufacturing Company, of Pittsburg, has secured a contract for the steel roof trusses.

Memphis, Tenn., Dec. 1, 1899.

MR. W. S. WALKER, being a contractor, has resigned the presidency of the Electrical Workers' Union, No. 50, of this city, and Mr. Charles A. Robinson has been elected to fill the vacancy. Mr. J. A. Myles is vice-president of the Union and Arthur Bramish, secretary. The Union has been in existence about three months and has 25 members.

Austin, Tex., Dec. 7, 1899.

TO IMPROVE THE ROAD.—The West End Street Railway Company, of San Antonio, has been reorganized and the new owners propose to make many important improvements.

A NEW TELEPHONE LINE is to be constructed from Wharton, Tex., to Bay City, Tex., by the Wharton & Bay City Telephone Company, which was recently incorporated with a capital of $5000.

TELEPHONE EXTENSIONS.—A new telephone line is being built from Lufkin, Tex., to Corrigan, Tex., by the American Telegraph & Telephone Company, of Nacogdoches, Tex. The line will also be extended to Houston.

ELECTRIC LIGHT FOR CALDWELL, TEX.—A private corporation is being organized at Caldwell, Tex., for the purpose of putting in an electric light plant to furnish lights for the streets as well as for residences and business houses.

REBUILDING ELECTRIC LIGHT PLANT.—The electric light plant owned and operated at Plano, Tex., by Stark & Co., was recently destroyed by fire. It is now being reconstructed, a complete line of new equipment having been purchased.

THE COURT OF CIVIL APPEALS at Austin, Tex., has just rendered a decision in the injunction suit of the El Paso Electric Light & Power Company vs. the City of El Paso, in favor of the defendant city. The municipal authorities of El Paso entered into a five years' contract with the plaintiff company for street lights. The mayor signed the contract, but after receiving a

protest from a mass meeting of indignant citizens, he withdrew his signature and vetoed the ordinance. The company claimed that the contract was binding, but the higher court takes a different view of the matter.

THE SOUTHWESTERN TELEGRAPH & TELEPHONE COMPANY is making important improvements and extensions to its system in Texas. The stringing of a No. 8 copper circuit from Waco to San Antonio has just been completed, thus giving San Antonio and intermediate points direct long distance communication with Chicago, St. Louis and the east. A force of men are now stringing four wires from Houston to Wharton, connecting the six wires that were recently completed from Wharton to Victoria. The company's new building at Waco is about completed. Its wires at Galveston will soon be placed underground. A copper circuit has just been strung between Beaumont and Orange, and between Gonzales and Shiner, giving those places much better service than formerly.

CANADIAN NOTES.

Ottawa, Ont., Dec. 9, 1899.

THE ROYAL ELECTRIC COMPANY, of Montreal, has just despatched to the Nova Scotia Steel & Iron Company, of Cape Breton, a complete electric lighting plant, consisting of one 75-kw S.K. C. two-phase generator, and a complete equipment of 60 alternating current enclosed arc lamps.

LORD STRATHCONA, the High Commissioner for Canada in London, England, has cabled to the authorities at Ottawa in charge of the Canadian exhibit for the Paris exhibition, that the contract for supplying the electric plant and light in the colonial buildings has been awarded to a Paris firm. It was hoped that a Canadian company would obtain the contract.

THE NIAGARA FALLS PARK COMMISSIONERS have reached an agreement with the Fort Erie Electric Railway Company, under which the latter will be allowed to extend its line for a distance of 13 miles along the bank of the Niagara River to Slater's Point. This extension brings the line within two miles of Chippewa, but the ground between the two points is already occupied by the Niagara Falls Park & River Railway. The company in occupation has not, however, been running cars between Slater's Point and Chippewa this season, and if it fails to do so much longer the park commissioners may cancel the existing agreement and transfer running rights to the Fort Erie Company The agreement between the commissioners and the Fort Erie Railway Company will shortly be submitted to the Ontario government for ratification.

General News.

THE TELEGRAPH AND TELEPHONE.

SHIPPENSBURG, PA.—The Cumberland Valley Telephone & Telegraph Company is building an exchange at Shippensburg.

WINCHESTER, VA.—The Winchester Telephone Company, has been organized; capital, $35,000. Incorporators: R. T. Barton, of Winchester, and others.

PHILADELPHIA, PA.—The Eastern Telegraph & Telephone Company, of Philadelphia, has been incorporated to operate telegraph and telephone lines; capital, $1,000,000.

DORCHESTER, MD.—The Dorchester Telephone Company has sold its county line from Cambridge to Federalsburg to the Union Telephone Company of Talbot County.

AUBURN, ME.—The Eastern Telephone Company, of Rockland, has received a permit to enter the city of Auburn, and it will have its exchange and line in operation there by the first of July, 1900.

WOODLAWN, VA.—The Woodlawn Telephone Company has been incorporated; capital, $2000. Incorporators: S. M. Robinson, S. C. Robinson, J. K. Caldwell, all of Woodlawn; E. M. McPeak, E. L. Nuckolls, both of Hillsville.

WOODSVILLE, N. H.—The Woodsville Telephone Company has been incorporated; capital, $3000. Incorporators: G. H. Kendall, F. P. Dearth, E. Fitzgerald, O. D. Eastman, all of Woodsville, N. H.; P. I. Baird, of Boston, Mass.

LANSDALE, PA.—The officials of the Standard Telephone Line, of Bucks County, and the Keystone Line, of Montgomery, have decided to connect their systems at Chalfont, the former company building from Doylestown to that point, and the latter from Lansdale.

ALTOONA, PA.—The Phoenix Telephone plant in this city has been sold presumably to the big telegraph and cable syndicate recently organized in Philadelphia and New York. The purchase price was $30,000, much more than the par valuation. The new company will assume control at once.

BOSTON, MASS.—The New England Telephone & Telegraph Company now has 53,000 telephone subscribers, not including between 4000 and 5000 of the Southern Massachusetts Company, recently absorbed. Subscribers to the New England Company are increasing at the rate of about 1000 per month.

ALBANY, N. Y.—The Sennett Telephone Company has been incorporated to operate in Sennett and Weedsport, Cayuga County; Elbridge and Jordan and other towns in Onondaga and Cayuga Counties; capital, $500. Directors: H. C. Crocker, S. C. Depew and Walter E. Spurr, of Sennett, Cayuga County.

ALBANY, N. Y.—The Columbia Long Distance Telephone Company was incorporated Dec. 6 with a capitalization of $50,000. Its general route is from Albany to various points all over the state. Among the directors are: Ernest J. White, Arthur R. Peck, Syracuse; J. J. Jernyrom, John L. Wentz, of Scranton, Pa. Each of the seven directors takes 80 shares apiece.

CHIPPEWA FALLS, WIS.—The Chippewa County Telephone Company was incorporated on Nov. 15 with a capital stock of $3000. The service is largely for the benefit of farmers in the vicinity. The company has built a toll line and expects to have its central office working at Chippewa Falls within a week or so. There is a good opening for an exchange at Chippewa Falls and Eau Claire.

LOUISVILLE, KY.—Arrangements are being made to organize a new telephone company, which will ask a franchise of the general council. H. N. Gifford, who was general manager of the Ohio Valley Telephone Company, which was sold out to the Cumberland Telephone Company some months ago, is believed to be at the head of the new enterprise. About a dozen Louisville capitalists have agreed to furnish the money.

MOUNT VERNON, N. Y.—A deal was completed on Dec. 3 whereby, it is said, the Telephone, Telegraph & Cable Company of America got possession of a majority of stock of the independent telephone lines of Westchester County. Its purchases include the New Rochelle Company, which has about 300 subscribers and owns franchises in White Plains and Mamaroneck, and the Palisade Telephone Company, which has franchises in Yonkers.

NEW YORK, N. Y.—The New York and Philadelphia Telegraph, Telephone & Cable Company has been incorporated at Trenton. The authorized capital of the company is $100,000. The company is formed to construct a telephone line across the state of New Jersey as a branch of the Telephone, Telegraph & Cable Company of America. The incorporators are: J. E. Hayes, Camden; George W. Beers, Fort Wayne, Ind.; John B. Stauffer, Philadelphia.

ROCHESTER, N. Y.—The Rochester Telephone Company, of this city, contemplates the building of additional toll lines. The apparatus used by the company is that of the Stromberg-Carlson Telephone Manufacturing Company, of Chicago. The switchboard has a capacity of 3600 drops. The company now has 2900 subscribers, 700 miles of local circuits and 60 miles of toll line. One hundred and fifty-six thousand feet of Standard Underground cable, with paper insulation, is laid in Camp tile conduits.

ELECTRIC LIGHT AND POWER.

WAYNETOWN, IND.—The Waynetown Electric Company is in the market for transformers, new boiler and engine, carbons, etc.

CINCINNATI, OHIO.—The Big Four Railway is erecting its own electric light plant at Bellefontaine, O., and it is stated will do the same in every point of importance along its lines.

DICKINSON, N. D.—The Dickinson Electric Light & Power Company is being incorporated by residents of this place. The company is capitalized at $10,000 and will commence work on an electric plant at once.

TRENTON, N. J.—The Lehigh Power Company has been incorporated to construct and operate plants for furnishing electric light, heat and power; capital, $500,000. Incorporators: George W. Griffiths, H. C. Cavanaugh and C. M. King, all of Jersey City.

DENVER, COL.—The Denver City Light & Power Company has been incorporated with a capital of $1,000,000. The company will erect an extensive plant in the Louisville mining district to furnish electric light and heat for Denver and a score of towns in northern Colorado.

KEARNEY, N. J.—The Standard Electric Light, Heat, Power & Manufacturing Company has been incorporated; capital, $25,000. Incorporators: Moses G. Wanzor, Great Neck, Nassau County, N. Y.; John W. Mitchell, Manhassett, Nassau County, N. Y.; Lorenzo Wood, Jr., Kearney, N. J.

BELLEVUE, OHIO.—Negotiations have been consummated in Cleveland which give the control of The Bellevue Light & Power Company to others than the local stockholders. The purchaser is Mr. C. H. Stewart, of Cleveland, and by the new deal he claims to now hold control of the entire property.

WATERVILLE, N. Y.—The Waterville Electric Light & Power Company has been incorporated to operate in Waterville, and the towns of Sangerfield, Marshall and Augusta, Oneida County; capital, $15,000. Directors: Marinus W. Terry and C. M. Wickwise, of Waterville, and H. B. Sweet, of Utica.

THE ELECTRIC RAILWAY.

XENIA, O.—The Dayton, Spring Valley & Wilmington Traction Company has been reorganized and rechartered, under the title Dayton & Xenia Traction Company.

DETROIT, MICH.—The differences between the Detroit Street Railway employees and employers will be settled by arbitration. A decision not to strike has been reached at a meeting of the men.

DUNKIRK, N. Y.—The common council has been restrained by an injunction of Supreme Court Justice Frank C. Laughlin, from taking any action toward granting a franchise to the Dunkirk & Point Gratiot Traction Company for a trolley line in this city.

SPRINGFIELD, ILL.—The secretary of state of Illinois has licensed the Galesburg & Monmouth Rapid Transit Company at Galesburg. The capital stock is $200,000, and the object is to build and operate an electric railway. The incorporators are Fred Seacord, Howard Knowles and Robert Chappell.

HARRISBURG, PA.—A charter was granted to the Wilmington & West Chester Railway Company with a capital stock of $60,000. The company is authorized to build from West Chester to the Delaware state line. J. H. Hoffecker, of Wilmington, is president. The line from Wilmington to the Pennsylvania state line will probably be built under a Delaware charter.

CHATTANOOGA, TENN.—The directors of the Chattanooga Rapid Transit Company have decided to build an extension of the line to St. Elmo, a suburb at the base of Lookout Mountain. The line will also be extended to Chickamauga Park, 10 miles from the city, at once. Clarence P. King, a Philadelphia capitalist, who represents a syndicate, was present at the meeting and agreed to furnish the capital to extend the lines and operate them.

BALTIMORE, MD.—The executive committee of the United Railway Company will pay the full interest on the income bonds and the dividend on the preferred stock in December. The amount to be disbursed will be 2½ per cent. on about $13,300,000 of income bonds issued in exchange for a similar amount of preferred stock. The amount required to pay the interest and dividend is $359,000.

COLUMBUS, O.—The Brice syndicate has made a proposition to the City of Columbus to take all the street railway franchises which the city may have to dispose of. They will make a 3-cent fare, giving to the city officials the privilege of increasing the fare to 5 cents and taking the 2 cents if they see fit. They offer to give a bond of $200,000 for the faithful performance of their contract. This proposition is the result of the city council having declared certain franchises held by the Columbus Railway Company void.

BOSTON, MASS.—The railroad commissioners have approved the issue of $170,000 original capital stock, and increased capital stock of $80,000 (total $250,000), by the Lexington & Boston Street Railway Company. The first sum is for building the roadbed and equipping, and the second for a power house. The railroad commissioners have also approved the absorption of the Norfolk Suburban, Waltham & Boston, and Norfolk Central electric roads by the West Roxbury & Roslindale road, under the latter title. An increase of stock of $337,500 by the West Roxbury & Roslindale is authorized to be used for the exchange of stock.

THE AUTOMOBILE.

AUTOMOBILE BUSSES.—A short bus line out of Newport, Ky., proposes to change to passenger automobiles and will endeavor to compete with the street cars in that direction.

MR. C. S. SMITH, formerly of the C. G. Smith & Sons' Company, bicycle parts manufacturers, Milwaukee, Wis., is erecting a factory in that city for carrying on experiments with the view to the manufacture of automobiles.

THE MILWAUKEE AUTOMOBILE COMPANY has been incorporated, with a capital stock of $100,000. W. H. Starkweather, formerly of the Milwaukee Engineering Company, Herman Pfiel and W. G. Smith are the incorporators.

THE AUTOMOBILE ALMANAC FOR 1900.—The Technical Office of the Automobile Magazine, 31 State Street, New York, has in preparation The Automobile Almanac for 1900 and Automobile Trade Directory for the use of automobilists, manufacturers, capitalists, investors, promoters and every one interested in automobile development. This almanac and directory will be exhibited at the Paris Exposition and will have a circulation in foreign countries as well as at home.

WOODS MOTOR CAB COMPANY.—Certificates of incorporation of the Woods Motor Cab Company, of Washington, and the Woods Motor Cab Company, of Detroit, have been filed at Trenton. The capitalization of each company is $500,000, of which $200,000 is 7 per cent. cumulative preferred stock and $300,000 is common stock. Each company is authorized, among other things, to carry on a general transportation business, both of passengers and of merchandise; to manufacture or purchase cabs and vehicles of all sorts, and to manufacture, store and supply motive power created by electricity or otherwise. It is said that compressed air will be the motive power of the vehicles.

NEW COMPANIES.

INTERNATIONAL ELECTRICAL INDICATOR COMPANY, Chicago; capital, $15,000; to manufacture and deal in electrical apparatus. Incorporators: F. E. Davidson, John P. Martin, Edward A. Delasaux.

ELECTRICAL ADVERTISING & EXHIBITION COMPANY, of Buffalo; capital, $2000. Directors: Charles E. Skinner, Pittsburg, Pa.; Paul M. Lincoln, Niagara Falls; William S. Skinner, Buffalo.

ELECTRIC BOILER PROTECTION COMPANY, of New York City, to deal in metal wares and brass goods; capital, $100,000. Directors: William W. Brauer, James C. Beebe, J. Thomas Lynch and Lyman E. Warren, New York City.

OBITUARY.

COL. PHILANDER P. LANE, one of the founders of the Lane & Bodley Company, Cincinnati, Ohio, died at his home near Cincinnati on Dec. 6, at the age of 78 years. He was born in Nassau, N. Y., in 1821. The partnership between himself and Mr. Joseph T. Bodley was effected in 1852. Deceased served in the civil war. He was one of the founders of the Ohio Mechanics' Institute and Industrial Expositions.

PERSONAL.

MR. CHAS. T. CHILD, formerly editor of THE ELECTRICAL WORLD, was married Nov. 30 to Miss Bertha May Cushing, daughter of Rev. John R. Cushing, of Malden, Mass. On behalf of its staff and the host of Mr. Child's friends in electrical circles, THE ELECTRICAL WORLD AND ENGINEER offers its hearty congratulations to the happy couple.

MR. W. J. JOHNSTON now numbers a shipwreck among his experiences of travel. While proceeding from Japan to Corea on the Satsuma Maru, that vessel was wrecked on Tsushima Island, off the southern coast of Japan. All hands were landed without loss of life, and for several days, until taken off by a rescuing vessel, the passengers lived among the native population, subsisting on their fare and sleeping in primitive quarters.

LEGAL.

FREIGHT ON SUBURBAN RAILWAYS.—The courts of Cuyahoga County, Ohio, have decided that suburban trains can haul freight through the city of Cleveland and that the municipality can offer no hindrance. This will allow suburban lines to go into a general freight business, a privilege which has long been denied them.

TELEGRAPH TOLLS IN KANSAS.—The act of the special session of the legislature reducing telegraph tolls in Kansas 40 per cent. was declared unconstitutional by Judge Hook in the United States Court. He held that the new rates were confiscatory. The Western Union Telegraph Company brought suit to enjoin the "court of visitation" from enforcing the telegraph law. Judge Hook held that the court of visitation could not exercise judicial powers.

Trade and Industrial Notes.

THE ELECTRIC APPLIANCE COMPANY, Chicago, is pushing Packard's Moguls and sign lamps for holiday and decorative lighting.

EXTENSION OF PLANT.—Contracts have been let by the Warren Electric & Specialty Company, of Warren, Ohio, for a large addition to its plant.

THE WATSON-STILLMAN COMPANY, manufacturer of hydraulic machinery, tools and supplies, 204 East Forty-third Street, New York, has opened a branch office at 453 The Rookery, Chicago.

THE INTERNATIONAL CORRESPONDENCE SCHOOLS, Scranton, Pa., are making an advantageous offer of a complete drawing outfit to all who enroll before Jan. 1 next. This outfit comprises everything needed by a first class draughtsman to do first class work.

THE CHICAGO BELTING COMPANY, 67 South Canal Street, Chicago. has issued the new price list for leather belting adopted by the Leather Belting Manufacturers' National Association. This price list was adopted at a meeting of the association held in New York City on Nov. 15 last and went into effect on Nov. 20.

THE WESTERN ELECTRIC COMPANY has issued a neat circular describing the Pendant Push Button Switch. The purpose of these switches is to connect chandeliers, fan motors, or other devices with the switch by means of a drop cord, allowing the switch to hang within easy reach. They are made in two sizes, viz., 5 amperes and 10 amperes.

THE LYNN INCANDESCENT LAMP COMPANY, of Lynn, Mass., has for some time past noticed a growing demand from many users of lamps for a first class low-priced lamp and has just put upon the market a lamp to meet this demand. It has also just made a new offer on burned out lamps which is said to be one of the very best ever made.

ANNUNCIATOR BULLETIN.—The Western Electric Company, Chicago, has recently issued a small four-page bulletin on annunciators, in which is given a list of its latest D style hotel annunciators and return call push button board. There are also listed a line of smaller annunciators and elevator annunciators. This bulletin is numbered 22 A, and a copy of the same may be had on application.

BALL ENGINE FOR PARIS EXPOSITION.—The engine which is to furnish the electric light and motive power for the special machinery exhibit of the United States at the Paris Exposition left New York a short time ago on the United States transport steamer "Prairie." This engine, which is a tandem compound of 350-hp direct connected to a generator, was built by the Ball Engine Company, Erie, Pa.

THE GREGORY ELECTRIC COMPANY, 62 South Clinton Street, Chicago, Ill., has just issued its December bargain sheet, containing a complete list of its apparatus in stock. This company makes a specialty of dealing in second-hand apparatus and when delivered by it guarantees it to be as good as when it left the factory. The company is at present enlarging its works, having rented the adjoining building and doubling its floor space.

THE M. C. BULLOCK MANUFACTURING COMPANY, Chicago, Ill., in a pamphlet just from the press, describes the improved Champion mine ventilator, which the company highly recommends for the general ventilation of mines, tunnels, buildings, etc. The chief features of this fan are its compactness, adaptability to conditions, and the ease with which the current of air can be reversed. The ventilator is illustrated in detail and application.

THE BELDEN-LARWILL ELECTRIC & MANUFACTURING COMPANY, Fort Wayne, Ind., manufacturers of the Belden arc lamps for all circuits, has recently issued three handsomely printed cards showing illustrations of these lamps and parts. Each card contains three half tone illustrations of some important feature of the lamp. These illustrations are very effective in creating an interest in this particular lamp. Copies may be had on application to the company.

MESSRS. CHARLES H. BESLY & CO., 10 North Canal Street, Chicago, Ill., report that their December business has started in unusually brisk. At their factory in Beloit, Wis., they are working 16 hours four days a week, the balance 10 hours per day. They report receiving numerous orders for their Helmet bronze in sheet for flat springs, and in wire for round springs. They carry a large stock of this material at their Chicago store, and therefore are prepared to make immediate shipments.

THE CENTRAL ELECTRIC COMPANY, Chicago, anticipates a large holiday demand for colored and miniature lamps, and to meet this demand has placed in stock an extra large line of these goods. The company recommends the use of vitro chrome and zero frost, with which very pleasing effects can be made at home by dealers or central station men on any incandescent lamps. Nickel plated climbers and plyers, or the "Wilson" torch, are stated by the Central Electric people to make most attractive and useful presents.

THE MAXWELL M. MAYER ELECTRIC COMPANY, 2365 Second Avenue, New York, is making a specialty of dynamos and motors in sizes of from 1 to 5-hp. It has been in receipt of such large orders that during the past three or four months its shop has been running continuously day and night. The company can now see its way out of the mass of orders that has been received. A very attractive little card illustrating the general design of the Mayer motors will be ready for distribution in a few days and copies may be procured by addressing the company.

ART CALENDARS.—The New York & Ohio Company, Warren, Ohio, has issued a neat calendar for the month of December. The calendar is on a heavy beveled edge cardboard, which also bears a reproduction of Schachinger's painting, entitled "Lost in Thought." It is the company's intention to issue similar calendars each month during next year, each calendar, however, having a reproduction of a different painting—the old and modern masters being thus represented. The New York & Ohio Company will be pleased to send the calendar to anyone in the trade on application.

THE SKINNER ENGINE COMPANY, of Erie, Pa., in a recently issued pamphlet, describes a new system of automatic lubrication as applied to the Skinner automatic engine. By the use of this system a continuous stream of pure oil is applied to every bearing and is in plain sight. It automatically separates the oil from the piston stuffing box leakage and produces complete purification of the oil by removing all abrasives and foreign substances. One automatic cycle of events returns the oil to the engine in its original condition. The system as applied to Skinner engines is illustrated by engravings.

THE BULLOCK ELECTRIC MANUFACTURING COMPANY, Cincinnati, Ohio, sold 51 machines during the month of November, several of them being repeat orders. A partial list of these orders was given in these columns last week. In addition to those specified there were four 15-hp direct current motors for the Oakland Transit Company, Oakland, Cal. (second order); one 30-kw generator for the American Type Foundry Company, Cincinnati (second order), and one 12½-hp direct current motor for the Pacific Coast Borax Company, Bayonne, N. J., this being the fifth order from this concern.

THE BOSSERT ELECTRIC CONSTRUCTION COMPANY, Utica, N. Y., in a little pamphlet just issued, gives a brief description of the Bossert plugged steel conduit boxes and the Erickson conduit insulators, of which line of goods it is the sole manufacturer and patentee. The prices of these articles are also given. The plugged steel conduit boxes and the Erickson insulators are both approved by the National Board of Fire Underwriters. In another pamphlet the line of panel boards manufactured by the same company is described and illustrated; also some very handsome switchboards constructed by this company.

THE WARREN MANUFACTURING COMPANY, No. 63 South Canal Street, Chicago, has recently issued some attractive literature for the electrical trade, describing its liquid pulley cover. The object sought in the use of this composition is to prevent slipping of belts and facilitate the operation of slack belts. This is done by an enameling process which leaves the pulley with a firm, adhesive and leather-like surface, having a natural affinity for belting. The ease of application of this cover, together with its other apparent merits, appeals to mechanics as a feasible method of eliminating the annoyances and losses caused by slipping belts.

THE SAFFORD ARC LAMP MANUFACTURING COMPANY, N. Y., has issued a folder in which is described the Tiny Lihtan arc lamp. This lamp is only 13 inches long and is of the enclosed arc type. It is especially adapted for window lighting and is said to give practically shadowless illumination. The standard Lihtan enclosed arc lamp manufactured by the same company is 24 inches long and takes from 3 to 6 amperes of current. It is adapted for both indoor and outdoor service and, like the Tiny lamp, is practically shadowless. The lamp will burn singly on ordinary direct current incandescent circuits of 90 to 225 volts. The mechanism is exceedingly simple, there being but one moving part.

ENGINEERING SOCIETY LIBRARY, UNIVERSITY OF MICHIGAN

"THE LIVING AGE" FOR 1900.—During the 56 years of its existence this sterling weekly magazine has steadily maintained its high standard. It is a thoroughly satisfactory compilation of the most valuable literature of the day. As periodicals of all sorts multiply, this magazine continues to increase in value; and it has become a necessity. By its aid the American reader can, with economy of time, labor, and money, keep well abreast with the literary and scientific progress of the age and with the work of the ablest living writers. It is one of the most comprehensive of magazines, and its prospectus for 1900 is well worth the attention of all who are selecting their reading matter for the new year. The Living Age Company, Boston, are the publishers.

CATALOGUE OF RIDGWAY DYNAMO & ENGINE COMPANY.—In a well written and handsomely illustrated and printed pamphlet of over 100 pages, the Ridgway Dynamo & Engine Company, of Ridgway, Pa., describes in thorough detail the Thompson-Ryan dynamo and McEwen engine. The portion relating to the Thompson-Ryan dynamo is a contribution of value to electro-technical literature, as it gives a very thorough account of all the details relating to the "balancing coil" system employed, the invention of Prof. Harris J. Ryan, and one of the most important of the more modern discoveries in dynamo design. The part of the catalogue devoted to the McEwen engine also contains much matter of intrinsic technical value, including a thorough description of the Begtrup inertia governor. This catalogue is an excellent illustration of the recent tendency toward giving a high technical value to trade publications.

THE WESTERN ELECTRICAL SUPPLY COMPANY, of St. Louis, has recently taken the exclusive territorial agency for the New Clifton iron armored insulating conduit in the south and west, covering some 20 states. The company reports that the success of this conduit has been instantaneous. It has been approved by the national board of fire underwriters, and everyone who has used it have been more than pleased. This conduit is rubber lined and can be bent in any shape, thereby dispensing with all elbows, and cheapening the cost of both labor and material. It is claimed that it is easier to draw the wires in this conduit than in any other on the market, since the pipe is treated and freed from burrs, and made perfectly smooth before lining. It is then lined and a finishing coat of soapstone is put on, thereby making a perfectly smooth surface. A single braid wire in this conduit is, the company states, approved by the underwriters.

Record of Electrical Patents.

UNITED STATES PATENTS, ISSUED DEC. 5, 1899.

[In Charge of Wm. A. Rosenbaum, 177 Times Building, New York.]

638,230. BINDING POST AND CONNECTION FOR ELECTRICAL APPARATUS; A. Fischer, New York. App. filed May 1, 1899. The end of the wire is soldered to a metal cap adapted to screw over a threaded post, the latter being set in an insulating support. The cylinder is surrounded by an insulating cover between which and the support for the post is inserted a soft rubber washer to make a moisture-tight joint.

638,232. ELECTRIC EXERCISING APPARATUS; C. L. Fortier, Milwaukee, Wis. App. filed Dec. 12, 1898. The exerciser comprises one or more movable handles which serve as the electrodes of an electric circuit, and as means for exercising the arms and body, and a mechanical retracting resistance, such as a weight or spring connected with the handle, to resist the pull of the operator. The electrical apparatus comprises a source of electricity, means for controlling the current, changing its course and varying its strength and connections for directing the current through different parts of the body and limbs of the operator.

638,233. ELECTRIC ROLLING MACHINE INDICATOR; A. P. Hine, Torrington, Conn. App. filed April 21, 1899. This is a circuit closer and indicator connected with a pair of rolls in a rolling mill to indicate the amount of work done by the rolls.

638,236. ELECTRIC HEATER; E. E. Gold, New York. App. filed June 1, 1899. The heater comprises a supporting rod, a coil of resilient resistance wire surrounding the same, the latter being so shaped that its convolutions are all eccentric to the rod and so touch it at one point only.

638,246. DIAPHRAGM; H. E. Husted and W. S. Jones, Jeannette, Pa. App. filed Oct. 26, 1898. (See page 940.)

638,249. ELECTRICAL EXCHANGE; A. E. Keith, J. Erickson and C. J. Erickson, Chicago, Ill. App. filed Dec. 16, 1895. (See page 940.)

638,281. AUTOMATIC ELECTRIC ELEVATOR; H. Rowntree, Chicago, Ill. App. filed July 18, 1898. An index is located in the elevator car to be operated by the passengers. By moving the index to a certain point corresponding to a certain floor, the elevator will start and come to a stop at that floor.

638,282. AUTOMATIC ELECTRIC ELEVATOR; H. Rowntree, Chicago, Ill. App. filed Feb. 6, 1899. The same general type of machine as the previous, means being also provided for automatically slowing down the motor as the car approaches its stopping place.

638,350. OUTLET BUSHING; J. L. Morgan, Kansas City, Mo. App. filed Oct. 11, 1899. An insulating bushing, consisting of a block provided with one or more openings through which the conductors may be led and having two flanges, one on each face, which rest against the lathing on the opposite sides of the partition and hold the block in place.

638,388. ELECTRIC HEATER; E. E. Gold, New York. App. filed June 20, 1898. A modification of the heater described in patent No. 638,236.

638,390. STORAGE BATTERY; W. W. Hanscom and A. Hough, San Francisco, Cal. App. filed April 6, 1899. (See Current News and Notes.)

638,408. ELECTRICALLY CONTROLLED LOCK COLLECTING OR OTHER BOX; F. Williams, Revere, Mass. App. filed March 27, 1899. This is an electrically controlled post office collecting box, which consists of a series of boxes electrically connected with each other and with a central station, whereby the opening of the boxes primarily is in the control of the central station, and whereby the opening of a box is noted at the central station by an indicator.

638,418. APPLIANCE FOR TELEPHONE SWITCHBOARDS; J. L. McQuarrie, Chicago, Ill. App. filed April 10, 1897. (See page 940.)

638,419. INKING DEVICE FOR TELEGRAPH REGISTERS; L. E. Oehring, Chicago, Ill. App. filed Feb. 26, 1898. The type-wheel dips into a reservoir of ink and the excess of ink taken up is wiped off the type just before the printing is done.

638,422. CURRENT SUPPLY CIRCUIT FOR TELEPHONES; C. E. Scribner, Chicago, Ill. App. filed Aug. 1, 1895. (See page 938.)

638,423. SIGNAL LAMP AND SOCKET; C. E. Scribner, Chicago, Ill. App. filed March 20, 1897. (See page 938.)

638,424. THERMAL PROTECTOR; C. E. Scribner, Chicago, Ill. App. filed March 29, 1897. (See page 938.)

638,425. SIGNAL FOR TELEPHONE SWITCHBOARDS; C. E. Scribner, Chicago, Ill. App. filed April 23, 1897. (See page 938.)

638,426. SUPERVISORY SIGNAL FOR TELEPHONE SWITCHBOARDS; C. E. Scribner, Chicago, Ill. App. filed Feb. 14, 1898. (See page 938.)

638,430. ELECTRIC ARC LAMP; E. P. Warner, Chicago, Ill. App. filed Aug.

6, 1898. The regulating mechanism of the lamp is adjusted to strike the arc at approximately the normal length, and an automatic adjustable device is thereupon put into a condition to engage and release the clutch when the latter moves in a reverse direction but a fraction of the distance which it previously traversed in striking the arc.

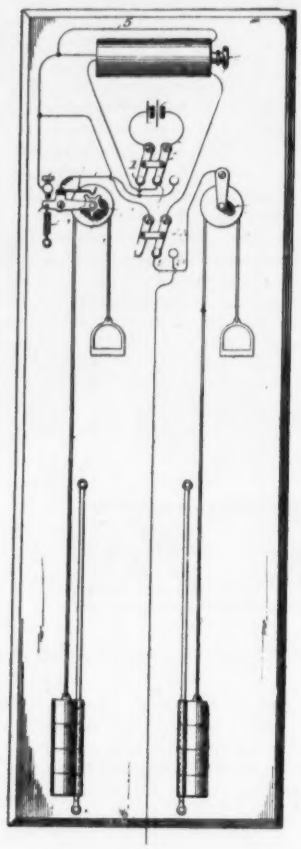
638,470. TROLLEY WHEEL; J. L. Osgood, Buffalo, N. Y. App. filed Aug 8, 1898. The hub is screw-threaded externally and a disk forming the thread occupies a central position thereon while two larger disks forming the flanges are held against opposite sides of the disk by nuts screwing over the hub. The parts are thus separable.

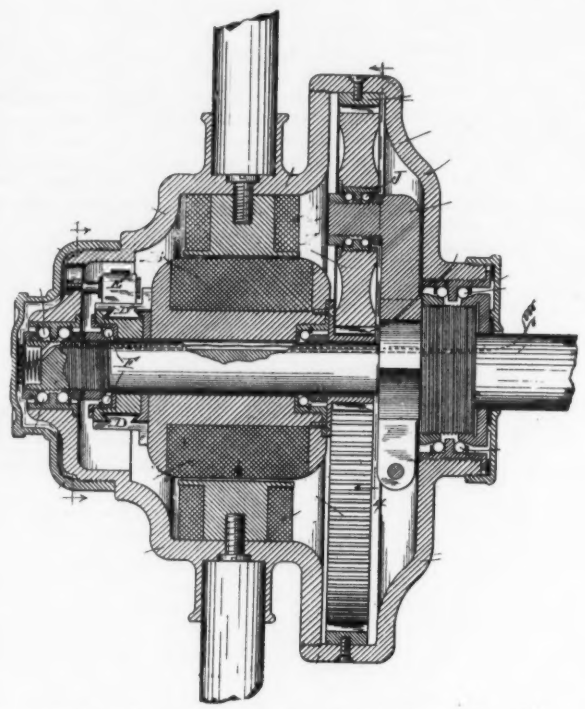
638,471. TELEPHONE SWITCH; S. B. Rawson, Elyria, Ohio. App. filed Dec. 15, 1897. (See page 940.)

638,472. SECONDARY BATTERY OR ACCUMULATOR; C. J. Reed, Philadelphia, Pa. App. filed Dec. 31, 1895. (See Current News and Notes.)

638,478. SIGNALING APPARATUS; J. G. Schreuder, Edgewood Park, Pa. App. filed Sept. 1, 1899. The object is to provide for the employment of a mechanism which by a continuous movement in one direction, will shift the semaphore or other signal from danger to caution and from caution to the clear position and will permit a stoppage of each signal at caution position as it automatically moves from clear position, and a continuation of the automatic movement of the signal from caution to danger position.

638,479. ELECTRIC ADVERTISING DEVICE; J. Scott, Toledo, Ohio. App. filed March 10, 1899. This is an electric sign having a glass face covered with an opaque paint readily removable. By means of a pen or scraper letters may be traced in the paint, which are illuminated by a light behind the glass. Bits of metal are attached to the glass and connected to one side of a circuit while the pen is connected to the other side so that as the pen moves across the glass sparks are thrown out.





638,232.—Electric Exercising Apparatus. 638,643.—Means for Propulsion of Vehicles by Electricity.

638,482. ELECTRIC GENERATOR OR MOTOR; N. W. Storer, Edgewood Park, Pa. App. filed July 28, 1899. (See Current News and Notes.)

638,511. ELECTRIC LIGHTING APPARATUS FOR VEHICLES; G. Heidel, St. Louis, Mo. App. filed Jan. 21, 1899. The invention consists of specific constructions and details in reference to the driving of a dynamo from the axle of a vehicle for lighting the same.

638,512. ELECTRIC ARC LAMP; G. Heidel, St. Louis, Mo. App. filed March 8, 1899. The carbon pencils are maintained in contact by a simple arrangement of a pair of coincident spring controlled sheaves by which the stem of the lower carbon holder connected thereto is gradually raised as the pencils are consumed.

638,521. TELEPHONE SWITCHBOARD; S. Morrison and T. L. Springer, McCordsville, Ind. App. filed May 19, 1899. (See page 939.)

638,522. ELECTRIC MOTOR CONTROLLING SYSTEM; F. B. Rae, Chicago, Ill. App. filed Feb. 18, 1898. (See Current News and Notes.)

638,542. PORTABLE BOAT MOTOR; J. F. Atwood, Chazy, N. Y. App. filed June 7, 1899. A casing containing the motor and gearing is mounted above the stern post and a vertical shaft extends downward from it to the propeller. The invention relates particularly to the devices for controlling the motor.

638,545-6. ELECTRIC ARC LAMP; Edward H. Belden, of Jackson, Mich. App. filed Oct. 17 and 19. The first patent is on the details of an arc lamp, employing no springs and having a controlling mechanism consisting of a toggle-joint lever arrangement actuated by a solenoid and operating a gripping dog which engages the flange of a wheel over which a carbon-suspending chain passes. The second patent is on a mechanism for automatically cleaning the inner globe of an enclosed arc lamp.

638,579. RECORDING APPARATUS; E. C. Hegan, Louisville, Ky. App. filed June 23, 1898. The object is to provide a recording apparatus for use on signaling circuits which is completely automatic in operation and arranged to furnish a full and complete printed record on a tape of all the work done during a given period with the date and the number of the circuit.

638,606. ELECTRIC SIGNALING APPARATUS; H. B. Taylor, Newark, N. J. App. filed April 27, 1899. Certain improvements in electrically operated railway signals. The mechanism is such that the signal may be operated and then detached from its operating mechanism so as to insure an instantaneous return of the signal when released.

638,607. RAILWAY SIGNAL; H. B. Taylor, Newark, N. J. App. filed Jan. 24, 1899. A railway signal comprising a semaphore having one or more electric lamps mounted on its blade, a circuit closer for the lamps in a supply circuit operated by the movement of the semaphore and an auxiliary circuit closer in the same supply circuit controlled by a relay in a track circuit, the auxiliary circuit closer depending for its operation on the location of a train.

638,614. ELECTRIC ARC LAMP; E. Woltmann, New York. App. filed March 19, 1898. The improvements relate to and consist of the details of the clutch and mechanism for operating it.

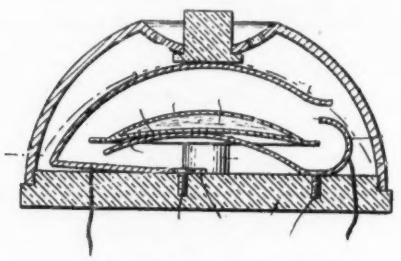
638,627. MULTIPLE BLADE STARTING SWITCH; G. S. Dunn, East Orange, N. J. App. filed April 29, 1899. (See Current News and Notes.)

638,635. DYNAMO ELECTRIC MACHINE OR ELECTRIC MOTOR; G. Heidel, St. Louis, Mo. App. filed March 1, 1899. The pole pieces have projections which enter the heads of the hollow field magnet cores and are secured therein.

638,643. MEANS FOR PROPULSION OF VEHICLES BY ELECTRICITY; F. J. Norman and F. Ledwinka, Chicago, Ill. App. filed May 19, 1899. The motors are located in the hubs of the wheels, the invention residing in the special constructions necessary.

638,679. ALTERNATING CURRENT GENERATOR; T. H. Hicks, Detroit, Mich. App. filed Jan. 2, 1899. Consists of a compounding arrangement for an alternating current generator furnishing current to a three-wire system, consisting of the induction coil for furnishing an exciting current to the generator, the induction coil comprising an iron core, two primary coils, each in series with one of the mains, and a secondary furnishing the auxiliary exciting current.

638,680. PUSH BUTTON; J. E. Howe, Boston, Mass. App. filed June 10, 1899. An expansible chamber containing a volatile material is placed inside of the push button in such a way that its expansion to a certain degree will close the circuit without destroying the usefulness of the device.



638,680.—Push Button.

GERMAN PATENTS ISSUED NOV. 23, 1899.

[In Charge of Dr. Ralph Julian Sachers, 120 Liberty Street, New York.]

105,088. CROSS SLIDE FOR SIMULTANEOUSLY OR ALTERNATELY ADJUSTING SEVERAL RESISTANCES OR CONNECTIONS; Elektricäts-Actien-Gesellschaft W. Lahmeyer & Co., Frankfort. App. filed April 17, 1898. Two slides, one above the other, and movable crosswise, can be changed in their relation by means of a rod and a handle passing through a slot in both of the slides. Both slides are connected, respectively, to the switches of adjustable resistances or to the starting device of the apparatus. The apparatus may be used for simultaneously operating a plurality of electromotors.

105,165. SWITCH WITH CURRENT-BREAKER; Allgemeine Electricitaets Gesellschaft, Berlin. App. filed Nov. 29, 1898. This device consists of a main contact-piece, which is connected to two auxiliary contact-pieces by means of two resistances. The two auxiliary contacts are also connected to each other. By operating the switch one of the auxiliary contacts will make connection ahead of time of the main-contact, whereas the other auxiliary contact will move somewhat later than the main-contact, and the sparking in breaking the short circuit current will be limited to an innoxious place.

105,186. AUTOMATIC ELECTROMAGNETIC CUT-OFF; Allgemeine Electricitaets Gesellschaft, Berlin. App. filed Sept. 11, 1898. This device belongs to that class in which the anchor producing the current-interruption, rotates between the poles of a horse-shoe magnet. The anchor itself forms part of the circuit between the two stationary contact-pieces and is actuated upon by a spiral spring, which causes a quick removal from its position.

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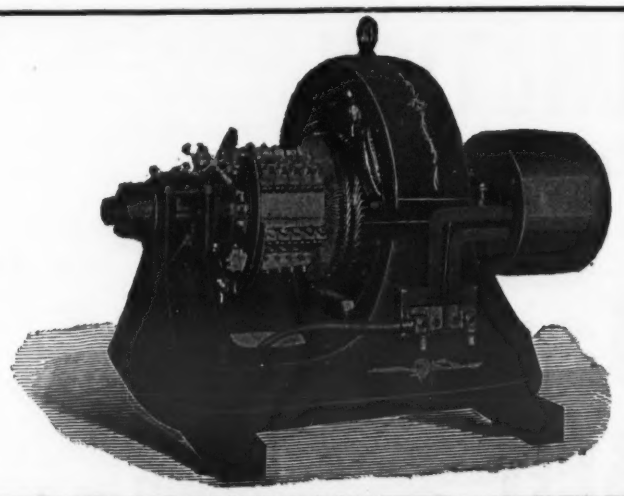

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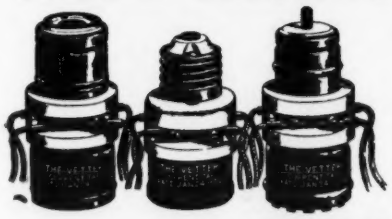

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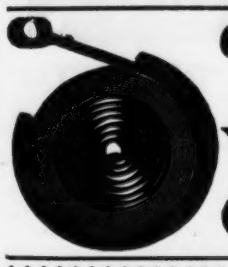

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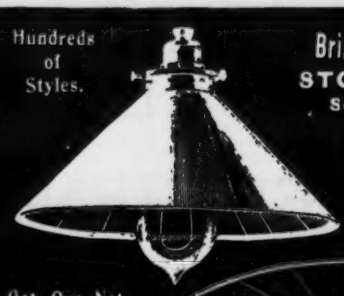
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